ELECTRICAL REVIEW

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5 FEBRUARY 1954

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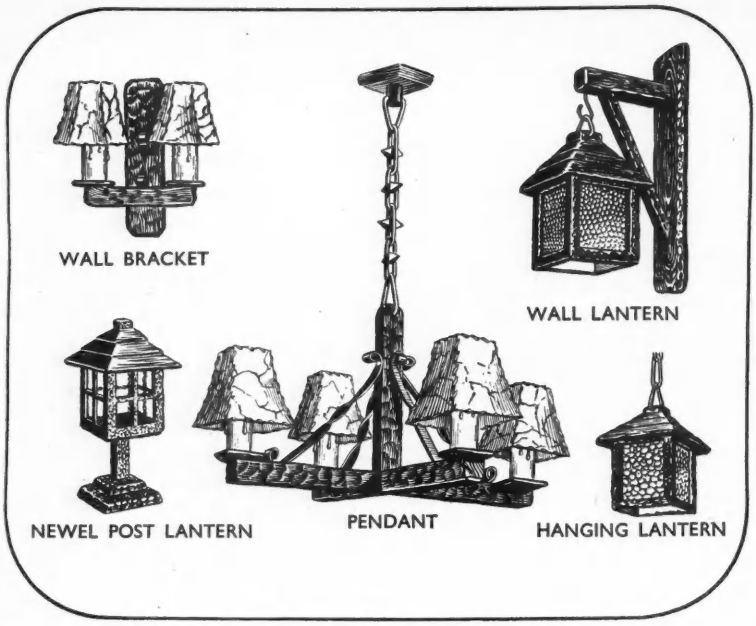

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ELECTRICAL REVIEW

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The Only Way Out

WHILE the Electrical Trades Union's war of nerves was still in progress it was pleasing to listen to the speech at the Association's annual dinner by Mr. S. L. M. Barlow, the president of the Electrical Contractors' Association (which embraces the National Federated Electrical Association). While not conceding that the Union's claim was justifiable, Mr. Barlow repeated the offer of the N.F.E.A. to submit the present wages dispute to an independent arbitrator, a course which seems to be the only way out of the existing deadlock. As the president remarked, the Union's contention that the normal negotiating machinery should be used is paradoxical now that that machinery has been so weakened by the Union's action. It certainly seems that the present situation has to be cleared up by other means before normal relations can be re-established.

Mr. Barlow put the employers' case very temperately. He expressed his Association's sincere desire that the employees should share in the industry's prosperity but rightly said that the prolongation of the dispute did not conduce to that end. It is quite certain that prosperity depends as much, or more, upon the electricians as upon the contractors and can therefore be achieved only by efficient and wholehearted work. If this could be assured the case for a wage increase would be established. The employers say that earlier undertakings by the men to improve " production " in return for wage increases, shorter hours, etc., have not been fulfilled.

The strikes organized by the Union not only affect the employers; they are holding up the work of a number of contractors and their employees who are not immediately concerned with the dispute. There are even repercussions upon our export trade. Although this may seem all to the good to the E.T.U. in its endeavour to enforce its demand, nobody really benefits in the end.

Up to the time of writing the Minister of Labour, to whom the dispute has been " reported " by the N.F.E.A., has not referred the matter to the Industrial Disputes Tribunal or taken other steps to secure a settlement. It is possible that he still hopes that the parties will take the advice of the Court of Inquiry, which he set up in September, and have the matter dealt with by their National Joint Industrial Council. But, as we have shown, the " attitude of suspicion and reserve " which the Court found to exist has not been altered, so far as the Union is concerned, and so resumption of operations by the N.J.I.C. is difficult. We can only hope, therefore, that the Union leaders will agree to independent arbitration to clear the way for a resumption of normal and more friendly relations.

ELECTRICITY AND STEEL

We have often stressed the outstanding importance of two particular electrical developments in the steel industry, i.e., the high frequency furnace and the cold rolling of steel strip, in that they have brought about immense commercial possibilities as the result of the greatly increased machining operations—deep pressings, etc.—permitted on the steel, and in some cases by completely eliminating the necessity for machining. Where these new outlets for steel are likely to lead commercially is still too great a speculation, but it may be said that there is a big undeveloped gap represented in the electric furnace world between the temperatures employed in the melting furnace and those used by the present heat treatment equipment (about 1,100 deg C). The following representative temperatures in the steel industry show clearly that much business awaits the employment of elements and housings which will operate satisfactorily at temperatures around, say, 1,600 deg C: Blast furnaces (pig iron), 1,600 deg C; open hearth furnaces (steel), 1,700 deg C; electrode arc furnaces (refining steels), 1,750 deg C; and soaking pits for holding ingots in preparation for refining and rolling, up to 1,400 deg C. All these duties could be carried out electrically as witness the operation of electric blast furnaces in such rich ore bearing countries as Norway.

TELEPHONE CABLE SUPPLIES

Early in December the Postmaster General, replying to a question in the House of Lords, suggested that the reason for the inability of the Post Office to provide individual telephones (instead of shared lines) was a shortage of telephone cables. Strangely enough, in the House of Commons on 20th January, the Assistant Postmaster General told a questioner that there was no difficulty in obtaining supplies of telephone cable from the manufacturers. Delay in providing telephones was due to capital restrictions but as the position grew easier they were "gradually increasing the allotment for local cables." The telephone cable manufacturers, who were perturbed by the original statement, naturally wish the subsequent amendment to be generally known. Such confusion, of course, has effects upon export trade and should be avoided. It should not be thought abroad that the British cable manufacturers are unable to meet the demand, for they certainly can.

MACHINE DRIVES

The paper "Electricity in the Wool Textile Industry" which was read recently before the Institution of Electrical Engineers by Messrs. A. J. Francis and T. H. Carr and reported in the *Electrical Review* of 22nd January again raised the old question of group *versus* individual driving and made us wonder if the call for individual driving was not sometimes a little too much a case of "being in the fashion." While the authors believed that the absence of shafts and belts alone was sufficient to justify any additional expenditure on individual driving they did make a case for the group drive, particularly where new driving schemes had to be superimposed on existing plant layouts which were not always ideally suitable for modern methods. We know of cases, however, where completely new production and driving installations have been established with the group drive in very recent times with outstanding success. The principal advantage of this, we should say, is constant speed for the various group-driven machines. An outstanding example of this is the modern flour milling installation where the numerous feeding belts, buckets and screws are all required to convey the product continuously at a constant rate. The group drive here permits excellent central control. But are we always quite sure of what we mean by group driving? Considering the many intricate movements in the individually driven loom, can we not regard this as an excellent example of group driving?

CREEP OF METALS

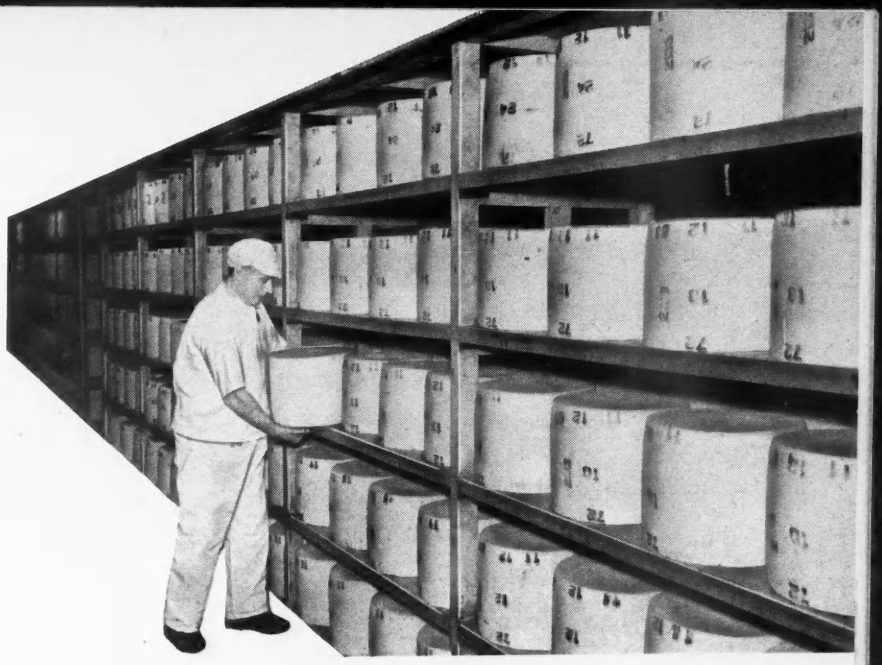
Increased efficiency in generation of recent years has arisen largely from the use of higher temperatures as quickly as metallurgists have been able to produce heat-resisting alloys economically. A principal factor is the limitation of steel deformation ("creep") after prolonged operation at temperatures above about 800 deg F. The importance of the time factor in this relationship was illustrated by Dr. J. M. Robertson in a paper reviewed in this issue in a reference to the ultimate tensile strength of the basic engineering material, mild steel. At atmospheric temperature this is about 28 tons/sq in and the breaking point is independent of working life, whereas at 900 deg F (the standard for 60 MW turbines) the figure falls to 16 tons and breakage would occur under a tensile stress of 6 tons if applied for 10,000 hours. That comparatively few cases of creep failure have occurred is no doubt due to the large amount of information accumulated through research before other factors made its use feasible.

THE POSITIVE APPROACH

Last week's annual conference of electrical housecraft advisers and senior demonstrators arranged jointly by E.D.A. and the E.A.W. provided a convincing demonstration of the transition from the negative to the positive sales approach resulting from the freeing of restrictions on promotional advertising. It has been said that, owing to the restrictions, selling of electrical appliances has largely become a lost art, and that the technique would have to be re-learnt. Whether this is true or not, those attending the conference certainly showed a keen interest in the suggested methods of approach. In fact so keen was the interest that demonstrators queried whether their own Boards were taking the opportunities for expansion of their activities seriously enough. We have no doubt that the Boards are fully alive to the importance of the situation but they should leave no doubts in the minds of any of their staff as to their energetic determination to make full use of the opportunities for development which are now offered.

Up-to-Date Methods at a Dorset Factory

CHEESE MAKING



WITH the end of cheese rationing there is likely to be a considerable revival of interest in its manufacture. Accordingly we visited a few days ago one of the most up-to-date electrically equipped factories in the country, that of the United Dairies (Wholesale), Ltd., at Bailey Gate, Dorset, which in the peak of the season every day converts on an average about 50,000 gal of milk into cheese as well as producing large quantities of lactose and cattle food from the by-product, whey.

Arriving by lorry, the churns of milk, after checking and sampling, go on mechanical conveyors to the tipping points where they are inverted above the receiving tank. After draining they pass back along another conveyor to an automatic washing machine in which they are washed successively in cold, warm and hot water and then dried and sterilized with hot air ready for reloading on the lorry.

From the tip tank the milk is taken, by means of a totally enclosed stainless steel pump direct coupled to a 5 h.p. electric motor, to an A.P.V. pasteurizing plant. It goes first to a plate heat exchanger for brine cooling before being passed on to a 3,000 gal storage tank where it is kept at a temperature of 45 deg F. From the storage tanks the milk is drawn as required for heat treatment. In this process the milk is first pumped to a balance tank and then through a flow controller to a regeneration section of the heat exchanger being warmed by milk which has already been pasteurized and then passing on to a heated section where the temperature is raised to 162 deg F. The milk is held at this temperature for fifteen seconds and then emerges to the regeneration section to complete the cycle of operations.

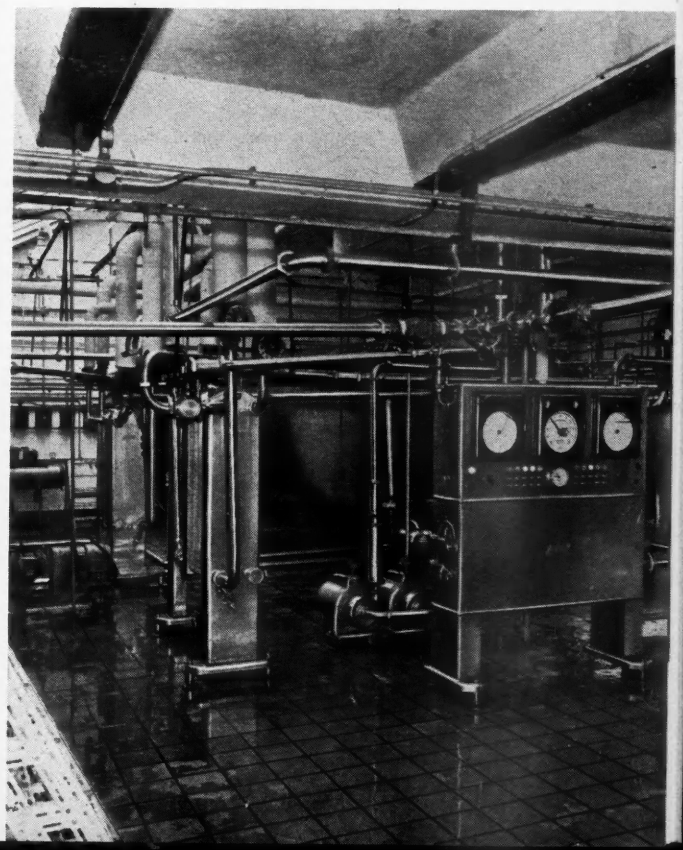
Temperature Control

The plant is heated by means of a hot water supply which is thermostatically controlled. Should the temperature of the milk fail to reach the predetermined level, the milk is automatically diverted from the holding section to the input side of the balance tank, the diversion continuing until the operator makes the necessary adjustment to ensure that the temperature of the milk does reach the required level and is maintained there for the desired period. After pasteurizing the milk is run into the cheese tubs.

Both audible and visual warnings of any diversion of the milk are given on a compact control panel which also indicates whether the protective devices are in operation and shows on Negretti & Zambra recorders the temperatures of both hot and cold milk. Regulation of the milk temperature is carried out pneumatically with the aid of an electrically operated compressor. Also mounted on the control panel are the push-buttons for the three phosphor-bronze pumps used for circulating the hot water round the heat exchanger. There are actually two complete self-contained pasteurizing plants, one of the three pumps being available as a spare for either system.

From the storage tanks the pasteurized milk is admitted to thirty-three 950 gal steam jacketed stainless steel cheese tubs arranged in two rows. Removable paddles fitted to the tanks for stirring purposes are driven by two

A section of the pasteurizing plant showing control panel



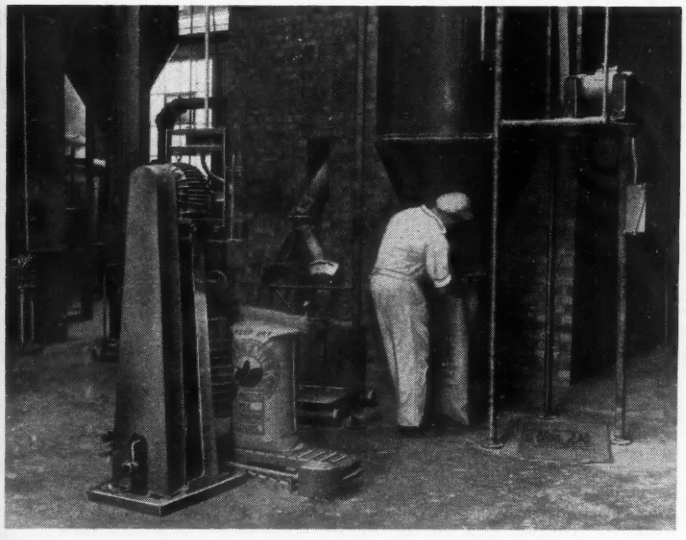
reciprocating shafts, one for each row, alternative steam and electric drives being provided. The paddles are connected to the operating shafts by dropping dagger shaped rods into slots.

As the bacteria contained in the milk are destroyed during the pasteurization process it is necessary to add about 1 per cent of "starter." This is a culture of lactic acid producing bacteria, specially prepared in the factory's laboratories, which are equipped with electrically operated ovens, boilers, incubators and refrigerators, all thermostatically controlled.

The temperature in the cheese tubs is then raised to 87 deg F and an hour after starting operations rennet is added to each tub. This causes the milk to turn to junket or, to use the technical term, coagulum. Thirty-five minutes later this coagulum is ready for cutting by means of multi sharp-edged knives, a highly skilled manual operation.

A general view of the cheese room

Grinder, cyclone, weighing machine and bag stitching machine in the calf food department



After the cutting is completed the temperature is taken up from 87 to 104 deg F in about an hour. During this cooking process the curd shrinks and becomes firmer. A half-hour's stirring follows after which the paddles are removed and the curd is allowed to settle. The opening of a tap in the bottom of the tub allows the whey to be run off, a process which takes about half an hour. About one-tenth of the original volume of milk remains at the bottom of the tank as curd.

A channel is cut in the middle of the curd to assist drainage. The two strips are then cut into four and the two inner ones turned, upside down, back on to the outer. Subsequent slicing gives a greater number of cut surfaces and makes the curd easier to handle, while turning the pieces over assists draining and equalizes pressure on the top and bottom of the slices. The drainage and "cheddaring" process continues for approximately 1¾ hours after the whey has been drawn off.

Rubbery in texture and insipid to the taste, the curd is then taken from the tubs and loaded into trucks which take it to the cutting machine. After being sliced into small pieces it is drawn backwards and forwards on a long table to absorb salt spread over it by hand. The curd is then put into tapered tubular moulds with tubular cloths and metal tops which are forced inside when the moulds are placed in the press. After a first pressing lasting twenty-four hours, the cheese is taken out, scalded and returned, reversed, to the mould for a further twenty-four hours. During pressing the depth of the cheese in the mould is reduced from 17in to 14in.

The cheese room is kept at a constant temperature of around 60 deg F, being warmed or cooled as circumstances demand by an air conditioning system.

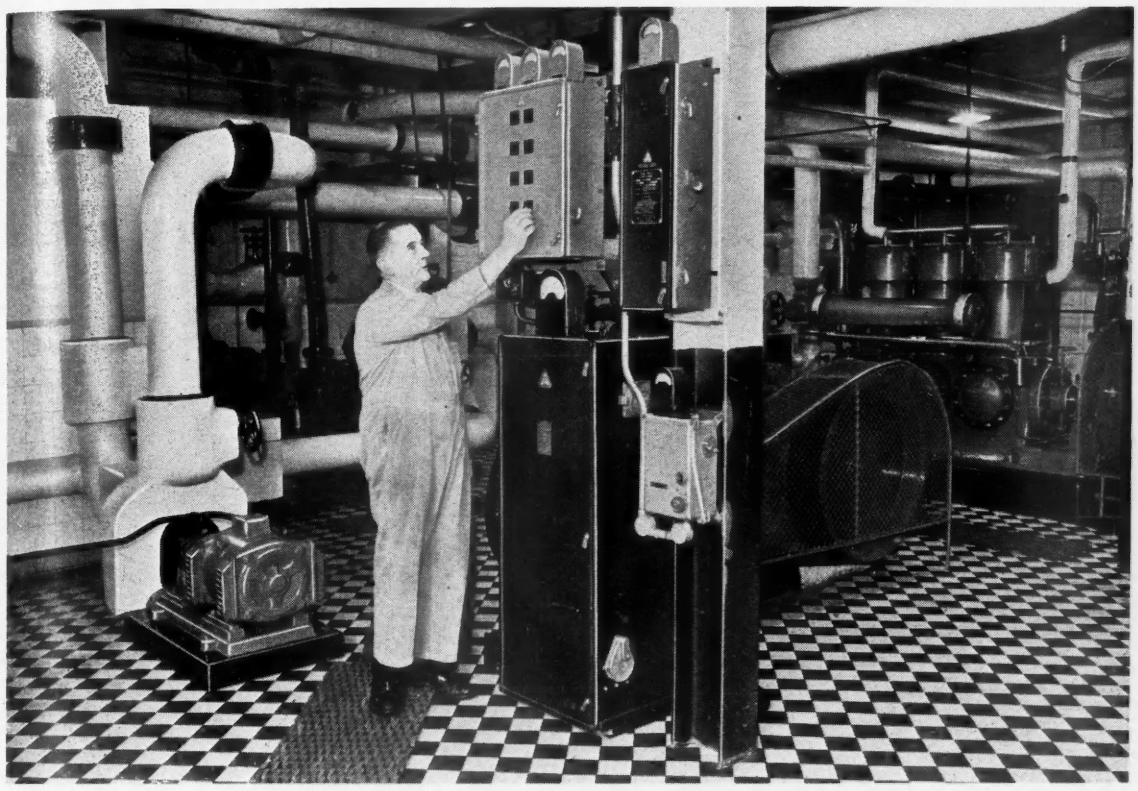
Conditioning Process

After finally leaving the presses the cheeses, each weighing approximately 70 lb, go to one or other of the two store rooms which together have a capacity of 5,000–6,000 cheeses. Here, turned daily, they remain for not more than three weeks, after which they are transferred to the company's depot at Wells where at the fourth week from manufacture they are graded, being ready for consumption in four to five months. With the aid of a further air conditioning system they are stored at a temperature of 50 deg F and at a controlled humidity, the protein content gradually breaking down with a resulting acquisition of the typical cheddar flavour.

The whey from the cheese room is pumped to storage tanks in a separate building, where it is manufactured into lactose and animal foodstuffs. The electrically driven plant here includes hydro-extractors, mills and ancillary drying plant.

For heating the factory, providing process steam and for operating both an ammonia compressor and a Belliss & Morcom double-expansion engine driving a 150 kW L.D.C. generator, there are four boilers: a Cochran 13,000 lb/hr unit with a variable speed motor driven mechanical grate, induced draught fan and a circulating pump for starting up when cold; a Babcock & Wilcox 20,000 lb/hr boiler with a chain grate stoker having a multi-speed gearbox and an Electroflo CO_2 meter and recorder; a 10,000 lb/hr Lancashire boiler with a Bennett stoker; a second Babcock & Wilcox unit with an evaporative capacity of 25,000 lb/hr and incorporating a Green's economizer and an induced draught fan. The coal handling plant is electrically driven.

About 100,000 gal of soft water is required for cooling purposes hourly. This is recirculated by means of steam turbine driven pumps and cooled for further use in the spray ponds; between 20,000 and 30,000 gal/day lost



Compressors, brine circulating pump and control gear

through evaporation is made up from well-water, softened. Two 250 gal/min Pulsometer pumps with 20 h.p. L.D.C. motors are arranged in duplicate to handle the effluent and another small pump is provided for washing the lorries.

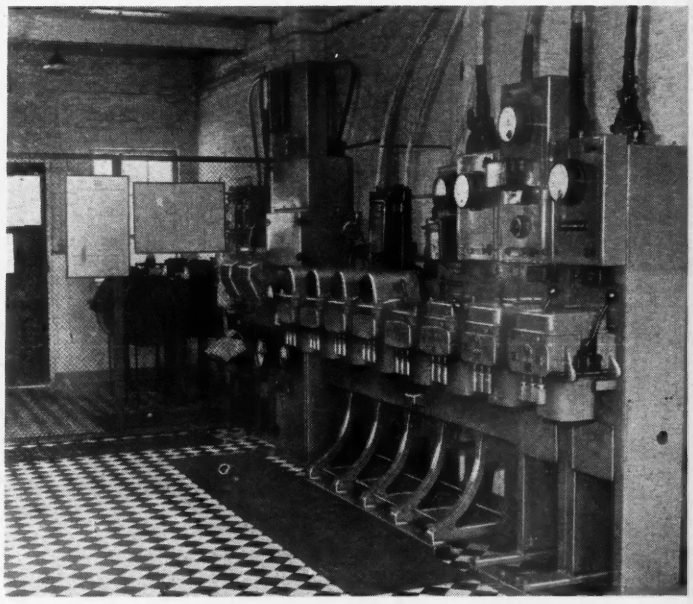
For chilling the brine employed for cooling the milk in the dairy and the cheese stores there are three U.D.E.C. ammonia compressors. The larger, used mainly in off-peak periods, is a three cylinder unit direct coupled to a 100 h.p. Crompton Parkinson motor running at 375 r.p.m.; it is provided with its own individual "Klad" circuit breaker and its starting gear incorporates an ammeter. A two cylinder unit of similar capacity is operated by a Belliss & Morcom steam engine. The third compressor is electrically driven by a 65 h.p. L.D.C. motor, E.A.C. switchgear controlling both the motor and the forced draught condenser used for cooling the ammonia coils. Four pumps, with motors of 2½, 6, 10 and 12½ h.p., circulate the brine round the various cooling systems.

Electricity Supply Arrangements

Apart from the locally generated 150 kW supply already referred to, the factory is provided with duplicate supplies from the Southern Electricity Board, Bournemouth Sub-Area, via two Long & Crawford 11 kV/400 V 250 kVA transformers and oil circuit breakers with a rupturing capacity of 75,000 kVA. Through h.r.c. fuse links the medium voltage supply is taken via an English Electric air break main switch to the main switchboard made up of Johnson & Phillips units of various capacities governing the supplies to the different sections of the factory. Interconnection is provided with the local generating set, Castell locks making it impossible for the two supplies to be connected to the busbars simultaneously.

To ensure the most efficient and economical operation of the plant the installation includes both Bryce power factor correction capacitors and an Aron supervisory maximum demand meter.

The main switchgear panel



Electrical Contractors' Dinner

THERE was, as usual, a very distinguished gathering at the annual dinner of the Electrical Contractors' Association and its allied bodies held at Grosvenor House, London, W.1, on 27th January. Mr. S. L. M. Barlow, president of the Association, was in the chair and the principal guest was Mr. J. R. Bevins, M.P., Parliamentary Secretary to the Ministry of Works, who proposed the toast of "The Allied Associations and Honorary Officials."

In his speech Mr. Bevins expressed the opinion that specialist contractors were often more knowledgeable than politicians. He went on to remark upon the great progress made by the electricity supply industry and said that the contracting business had developed with it in size and standards. Referring to the expansion in house-building, the speaker mentioned the relaxation of licensing requirements which had quickened the pace. All this would help to sustain the demand for the electrical contractors' services.

The general prospect before the industry was a pleasant one but at the moment there was a small dark cloud hovering over it which was being anxiously watched by the nation. Full employment was an agreeable thing but we were apt to regard it as a sort of law of nature. Yet we could not take it for granted. Many factors had contributed to the maintenance of full employment since the war but conditions were changing. Our present stability was narrow-based and likely to be affected by circumstances beyond our control. But our ability to maintain exports rested mainly in our own hands.

There were certain things that the Government could do and was trying to do, but the important things—quality, delivery dates and, above all, costs—depended on industry itself. In this the electrical contracting industry was concerned because every increase in the cost of production, whether in home or export trade, had inevitable repercussions outside the particular industry and debilitated our economic health.

Costs were determined by what we got out of industry. If we were too narrow, cautious and small-minded the answer was a miserable hand-to-mouth existence. The challenge to our generation was a challenge to boldness, imagination and drive to open up expansion on a grand scale.

President's Reply

Replying to the toast Mr. Barlow said that there was a wide recognition of the fact that this country could only continue to exist by holding its own in the export field. In recent months there had been encouraging increases in exports and, to a limited extent, a restoration of our economic solvency, but he wondered whether there was a universal recognition of the need for greater effort.

In the electrical contracting industry, as in other trades throughout the country, there was still a lagging behind in the field of production. Taking the building industry, with which electrical contractors were closely linked, production had increased by only 4 per cent since 1948 and that reflected their own experience. If official figures were published comparing the situation with that before the war we would be brought to a realization of the seriousness of the present situation. In 1948, moreover, there were adverse factors which did not now apply. Except for certain special items there were now no shortages of essential materials nor could any lack of energy-building foods now be said to have an adverse effect upon production.

The essential need was the restoration of the will to work and pride in craftsmanship which were the essential ingredients in the supremacy which this country once enjoyed.

In this connection Mr. Barlow touched upon the present dispute between the Association and the Electrical Trades Union. The Association had a genuine desire that all its members' employees should enjoy a high standard of living and share in the industry's prosperity. But the prolongation of the dispute was steadily but surely depreciating those objectives. It was paradoxical that, after weakening the normal negotiating machinery by victimizing the members of the Association who gave their time and effort to the regulation of wages and conditions, the E.T.U. should now endeavour to reach a settlement through that very channel.

Surely the only sensible course in such circumstances was to obtain an immediate and equitable settlement through the good offices of an independent and unbiased third party. Then both parties should take immediate steps to rebuild the industry's normal machinery of negotiation in an atmosphere of trust and good faith.

Time and money were being wasted at a time when all should be united in a drive to put this country in the forefront of world trade. He sincerely appealed to the members of the Union to join with the Association in sinking their differences and to endeavour to work together in settling any future disputes through the constitutional machinery, but to make such a future possible by commencing on the sound footing of genuine industrial peace.

After travelling in the United States, Canada, South America and in some European countries he could not over-emphasize that while their industry was capable of the greatest and most highly skilled output in the world, it was urgently necessary that all their energies should be devoted to that end rather than to industrial strife.

Failure of Incentives

They had tried in the past to give a wages increase as an incentive to higher production but that had not achieved the desired result. Nor had the reduction of the working week brought the improvement which had been promised. Since the war the contracting industry had gone to considerable lengths to improve the lot of its employees, including holidays with pay, but although all those benefits were desirable the stage had been reached at which neither the public nor the employers could bear additional costs; only increased production could promote further benefits.

After mentioning the increasing interest of members in overseas business, Mr. Barlow said that on the "home front" there was growing recognition that the trading structure of the industry needed substantial review; there was obviously a need to define more clearly the respective spheres of activity as between manufacturers, wholesalers, and electrical contractors and retailers. These were internal matters in which he was hopeful that spectacular progress would be made in the immediate future.

Mr. Barlow went on to say that he was convinced that the Government should protect the public against shoddy and dangerous electrical appliances and he asked if it were not time that some of the requirements of British Standard Specifications were made mandatory. The Association welcomed the activity of the British Electricity Authority and Electricity Boards towards establishing a national safety code for installation work instead of leaving matters to individual inspectors.

But even a safe installation could be abused by subsequent extensions and he suggested that a Government Committee should be appointed to explore the subject of the sale of accessories to the public. After a reference to the progress in the sale of electricity the president concluded with an appeal for the continued co-operation of all sections of the industry.

Mr. M. R. H. Sadler (vice-president) proposed the health of the guests in a felicitous speech and referred to many by name to show how widespread their representation was.

In responding Mr. Harold Bishop, C.B.E., President of the Institution of Electrical Engineers, referred to the links between the Institution and the E.C.A. The two bodies were in agreement about shoddy apparatus and installations and the I.E.E. Wiring Rules were a co-operative

Above: 1. Mr. T. W. Heather being greeted by the President. 2. Sir Percy Mills and the President. 3. Messrs. A. H. Carmichael, H. E. Helwig and F. E. Everard. 4. Mr. E. R. Wilkinson and Dame Caroline Haslett. 5. Messrs. G. Grosvenor and L. C. Penwill (director and secretary). 6. Messrs. V. W. Dale and E. Long. 7. Col. C. Banks, M.P., and Mr. J. R. Bevins (principal guest). 8. Messrs. E. G. Plucknett, K. Macrae Moir and C. R. King. 9. Messrs. H. T. Young, R. A. Marryat and T. E. Alger

At the centre of the top table: Mr. T. E. Alger, Lord Citrine, Mr. M. R. H. Sadler, Mr. J. R. Bevins, M.P., the President, Mr. W. T. Trace and Mr. H. Bishop

effort which had greatly raised the prestige of British electrical installation work. These regulations were being recast by the Committee, under the chairmanship of Mr. P. V. Hunter, and the thirteenth edition would be in two parts so that electricity undertakings could use them as an inspection standard. Part 1 would include the items legally enforceable under the Electricity Commissioners' 1937 Regulations, while Part 2 would contain recommended methods of complying with Part 1. There would be no reduction in the safety requirements.

Education and training was another aspect of the I.E.E.'s work in which the E.C.A. was assisting, Mr. Barlow being a member of the Committee dealing with the subject.

Sir Percy Mills, K.B.E., also replied to the toast, and congratulated the Association on the "toughness and courage" with which it was facing its present difficulties. The will of the majority could over-ride the law but the dispute in the contracting industry was a case of a minority over-riding the interests of the majority. They must find a way out of this or it would be the end of industrial negotiation and then the Government would have to take a hand in it.

Mr. H. T. Young, in proposing the president's health, said that his statesmanlike speech had shown him to be worthy of the company of his distinguished predecessors. Mr. Barlow briefly replied and this concluded the formal proceedings. There was time after the dinner for a reunion of which many of those present availed themselves.

NEW BOOKS

Shows and Exhibitions for Business Men. By J. M. Templeton (124 pp.). Elliot's Right Way Books, Kingswood, Surrey. Price 6s.

After a brief general historical survey of methods of displaying goods for sale this book deals in the same way with trade fairs—believed to have originated in France in the fifth century. The third chapter discusses the organization of a number of such exhibitions and indicates some of the results accruing from them.

Later more detailed studies of particular examples and the methods of running trade fairs are made and some idea is given of the costs and returns. Such matters as publicity, sites and design are dealt with and the book concludes with an index to established markets, fairs and exhibitions, at home and overseas.

Altogether this work is an interesting general introduction to the subject and it contains quite a number of practical points.—J.H.C.

Circuit Theory of Electron Devices. By E. M. Boone. Pp. 483; figs. and index. Chapman & Hall, Ltd., 37, Essex Street, London, W.C.2. Price 68s in the United Kingdom.

In view of the plethora of books with titles similar to that chosen by Professor Boone, it is interesting to isolate the differences between his work and the familiar standards. The main novelties are the early introduction of the active linear four pole network equivalent to a valve and the inclusion of a chapter on transistors in which both class A and junction type transistor circuits are fully discussed, again from the aspect of network theory. Other unusual inclusions are the analysis of Class C stages by means of the constant current loci on a grid-voltage/anode-voltage diagram and a rather deeper analysis of oscillator circuits than usual. Distortion and modulation, both a.m. and f.m., are fairly fully discussed.

A careful reading of this book combined with working the exercises should provide the equipment necessary to analyse any circuit problem met in design work at frequencies below a few megacycles. The problems of television circuits and u.h.f. circuits are not included. A good and useful but not outstanding book.—A.H.B.

Fundamentals of Electronic Motion. By W. W. Harman. Pp. 319; figs. and index. McGraw-Hill Publishing Co., Ltd., 95, Farringdon Street, London, E.C.4. Price 46s 6d in the United Kingdom.

In his preface the author emphasizes that this book is largely designed to illustrate the application of mathematical analysis to electron devices, especially from the viewpoint of the user. The chapter headings are as follows: Fields and Electrons, Motion in a Static Electric Field, Electron Properties and Sources, Motion in a Magnetic Field, Negative and Positive Space Charge, Motion in Time-Varying Fields, Space-charge Waves and Velocity Modulation, Travelling-Wave Amplification, Travelling-Wave Magnetron Amplifiers and Oscillators, Relativistic Electrodynamics.

The treatment is clear and concise and is well illustrated with carefully chosen diagrams. However, as might be expected from the preface, the analysis is rarely pushed far enough to give results significant in valve design. The result is that the book is dull and one can well understand that the author's students complain, as he says, that he is disguising a course in applied differential equations under a fancy title.—A.H.B.

BOOKS RECEIVED

Electric Traction Handbook (Control). By R. Brooks, B.Sc.(Eng.), M.I.E.E. Pp. 322; figs. and index. Sir Isaac Pitman & Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 30s.

Ultra-High-Frequency Radio Engineering. By S. A. Knight, F.R.S.A. Pp. 256; figs. 202; index. Sir Isaac Pitman & Sons, Ltd. Price 21s.

Electrical Engineering for Mining Students. By G. M. Harvey, M.Sc., B.Eng., M.I.E.E. Second edition. Pp. 158; figs. 108; index. Sir Isaac Pitman & Sons, Ltd. Price 15s.

Power and Process Steam Plant. Edited by E. Molloy. Pp. 184; figs. and index. George Newnes, Ltd., Tower House, Southampton Street, London, W.C.2. Price 17s 6d.

Cathode Ray Tubes. Edited by M. G. Say, Ph.D., M.Sc., M.I.E.E. Pp. 216; figs. and index. George Newnes, Ltd. Price 25s.

The Synchronous Induction Motor. By [illegible] Griffin, A.M.I.E.E. Pp. 136; figs. 55; index. Macdonald & Co. (Publishers), Ltd., 16, Maddox Street, London, W.1. Price 18s.

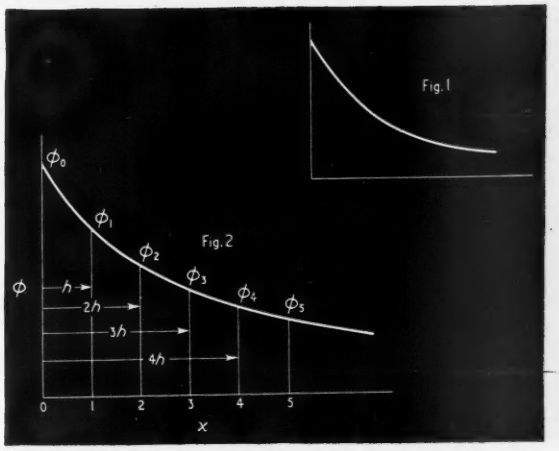
Electric Trains and Locomotives. By B. [illegible] Cooper. Pp. 111; figs. 72; index. Leonard Hill, Ltd., 9, Eden Street, London, N.W.1. Price 15s.

Elementary Electrical Engineering. By A. [illegible] Clayton, D.Sc.(Eng.)Lond., M.I.E.E., and H. J. Sharpley, B.Sc., A.M.I.E.E. Fourth edition. Pp. 490; figs. 340; index. Longmans, Green & Co., Ltd., 6 and 7, Clifford Street, London, W.1. Price 14s.

The Estimation of Gradient

Application of Numerical Approximation Methods

By JOHN WEBB, B.Sc.*



In analysing experimental data which are available in the form of a smooth graph, it is often required to estimate the rate of change at some particular point, or at a series of points. It is the purpose of this article to offer a method whereby the slope of the graph can be determined at any point. The accuracy of the method must obviously depend upon the accuracy of the data supplied.

Fig. 1 is a graph of a type commonly encountered in engineering: thus it could represent the fall-off in temperature through a heat insulator, the change in pressure in a cylinder, or the fall-off in potential in the dielectric surrounding a conductor. The gradient of the graph in each of these cases is of great engineering interest more especially at the point where the gradient is a maximum.

Suppose now that Fig. 2 is such a graph, and that it shows the variation of a quantity ϕ plotted against x, and let the points 0, 1, 2, etc. be chosen at equal and convenient intervals, along the x axis. The accuracy of the result increases as the interval, h, is decreased. Erect the ordinates ϕ_0, ϕ_1, ϕ_2, etc. at the points 0, 1, 2, etc. These ordinates are measured in the units of ϕ. The values of ϕ_1, ϕ_2, ϕ_3, etc. are then expressed in terms of the value ϕ_0 using the well-known Taylor expansion

$$f(x \pm h) = \epsilon^{\pm hD} f(x)$$

where $$D = \frac{\partial}{\partial x}$$

writing $$\theta = h\frac{\partial}{\partial x}$$

then $\phi_1 = \epsilon^{\theta}\phi_0$, $\phi_2 = \epsilon^{2\theta}\phi_0$, $\phi_3 = \epsilon^{3\theta}\phi_0$, etc.

The exponential terms are now expanded; fifth order and higher order terms in the series are omitted. Thus

$$\phi_1 = \phi_0 + \theta\phi_0 + \frac{\theta^2}{2}\phi_0 + \frac{\theta^3}{6}\phi_0 + \frac{\theta^4}{24}\phi_0$$

$$\phi_2 = \phi_0 + 2\theta\phi_0 + \frac{4\theta^2}{2}\phi_0 + \frac{8\theta^3}{6}\phi_0 + \frac{16\theta^4}{24}\phi_0$$

$$\phi_3 = \phi_0 + 3\theta\phi_0 + \frac{9\theta^2}{2}\phi_0 + \frac{27\theta^3}{6}\phi_0 + \frac{81\theta^4}{24}\phi_0$$

$$\phi_4 = \phi_0 + 4\theta\phi_0 + \frac{16\theta^2}{2}\phi_0 + \frac{64\theta^3}{6}\phi_0 + \frac{256\theta^4}{24}\phi_0$$

Although θ is an operator, these equations can, with care, be manipulated as ordinary algebraic simultaneous equations.

Thus

$$24\theta\phi_0 + 12\theta^2\phi_0 + 4\theta^3\phi_0 + \theta^4\phi_0 = 24(\phi_1 - \phi)$$
$$48\theta\phi_0 + 48\theta^2\phi_0 + 32\theta^3\phi_0 + 16\theta^4\phi_0 = 24(\phi_2 - \phi_0)$$
$$72\theta\phi_0 + 108\theta^2\phi_0 + 108\theta^3\phi_0 + 81\theta^4\phi_0 = 24(\phi_3 - \phi_0)$$
$$96\theta\phi_0 + 192\theta^2\phi_0 + 256\theta^3\phi_0 + 256\theta^4\phi_0 = 24(\phi_4 - \phi_0)$$

From which

$$\theta\phi_0 = \frac{\begin{vmatrix} 12 & 4 & 1 & 24(\phi_1-\phi_0) \\ 48 & 32 & 16 & 24(\phi_2-\phi_0) \\ 108 & 108 & 81 & 24(\phi_3-\phi_0) \\ 192 & 256 & 256 & 24(\phi_4-\phi_0) \end{vmatrix}}{\begin{vmatrix} 24 & 12 & 4 & 1 \\ 48 & 48 & 32 & 16 \\ 72 & 108 & 108 & 81 \\ 96 & 192 & 256 & 256 \end{vmatrix}}$$

$$= \frac{25\phi_0 - 48\phi_1 + 36\phi_2 - 16\phi_3 + 3\phi_4}{12} \quad \ldots.(1)$$

But $\theta\phi_0 = h\frac{\partial\phi_0}{\partial x}$

$$\therefore \frac{\partial\phi_0}{\partial x} = \frac{25\phi_0 - 48\phi_1 + 36\phi_2 - 16\phi_3 + 3\phi_4}{12h}$$

Using this formula the gradient at the point 0 is calculated from the values of the ordinates ϕ_0, ϕ_1, ϕ_2, etc. which are measured from the graph. If h is measured in centimetres the gradient is immediately available as, say, volts/cm assuming ϕ to be in volts.

Exactly the same method may be used to derive the following formulæ which are less elaborate than formula 1. Thus, if fourth order differentials and higher orders are omitted from the expansions—

$$\frac{\partial\phi_0}{\partial x} = \frac{11\phi_0 - 18\phi_1 + 9\phi_2 - 2\phi_3}{-6h} \quad \ldots.(2)$$

This formula is adequate for most calculations but when the gradient is very large, formula (1) will give appreciably increased accuracy. When third and higher order differentials are omitted from the expansions:—

$$\frac{\partial\phi_0}{\partial x} = \frac{6\phi_0 - 8\phi_1 + 2\phi_2}{-4h} \quad \ldots.(3)$$

The use of formula 3 is not recommended when the gradient is other than "gentle," although by using this formula one would probably get a closer approximation to the slope than would be possible by the use of the alternative method which involves the drawing of "alleged" tangents. Formulæ such as those given are of particular importance in the analysis of data obtained by electrolytic tank measurements or relaxation solutions.

If we now consider the temperature gradient in the

* College of Technology, Belfast.

dielectric of a single-core concentric cable it will help to illustrate the use and the accuracy of the formulæ which have been derived. The problem of finding the temperature at any point in the dielectric of a single-core concentric cable is exactly analogous to the same problem for the lagged steam pipe, and to the problem of finding the potential at any radius in the dielectric of the single-core concentric cable. The assumptions are that the dielectric is homogeneous in electrical and in thermal properties and secondly that the conductor and the sheath are in the first case isothermals and the second case equipotentials.

For convenience, if the conductor temperature is taken as 100 deg and that of the inner surface of the sheath as 0 deg, then the temperature T_x at any radius x is given by the expression

$$T_x = 100 \left[\frac{\log_e \frac{R}{x}}{\log_e \frac{R}{r}} \right]^\circ \qquad \ldots.(4)$$

Here R is the radius of the sheath and r the radius of the conductor. From formula 4 the temperature gradient is obtained by differentiation.

$$\text{Thus } \frac{dT_x}{dx} = - \frac{100}{x \log_e \frac{R}{r}} \text{ °/cm}$$

Now if R = 6 cm and r = 1·5 cm the temperature gradient at the conductor surface:—

$$\frac{dT_0}{dx} = \frac{-100}{1{\cdot}5 \log_e 4} = 48{\cdot}1 \text{ °/cm.}$$

It should be stressed here that this represents the exact solution (to one decimal place).

The temperatures at various points in the dielectric are worked out using formula 4 and are listed in the table and again the figures are exact values.

TEMPERATURE GRADIENT IN A SINGLE-CORE C/C CABLE

Distance from conductor surface (cm)	0·0	0·5	1·0	1·5	2·0
Temperature (deg) ..	100·0	79·2	63·2	50·0	38·9

Now suppose that these values were obtained experimentally and that the law governing the temperature distribution is not known, then the approximate formulæ Nos. 1, 2 and 3 could be used to estimate the gradient at the conductor surface. If these formulæ are of any use the gradient obtained must be close to the value 48·1 deg/cm. Thus using formula (1)

$$\frac{\partial T_0}{\partial x} = \frac{25 \times 100 - 48 \times 79{\cdot}2 + 36 \times 63{\cdot}2 - 16 \times 50 + 3 \times 38{\cdot}9}{12 \times \frac{1}{2}}$$

$$= 48{\cdot}38 \text{ deg/cm (approximate error 0·6 per cent)}$$

Using formula (2)

$$\frac{\partial T_0}{\partial x} = \frac{11 \times 100 - 18 \times 79{\cdot}2 + 9 \times 63{\cdot}2 - 2 \times 50}{-6 \times \frac{1}{2}}$$

$$= 47{\cdot}7 \text{ deg/cm (error } \simeq 0{\cdot}83 \text{ per cent)}$$

Using formula (3)

$$\frac{\partial T_0}{\partial x} = \frac{6 \times 100 - 8 \times 79{\cdot}2 + 2 \times 63{\cdot}2}{-4 \times \frac{1}{2}}$$

$$= 46{\cdot}4 \text{ deg/cm.}$$

The error has risen to about 3·5 per cent. (In each case the negative sign is dropped. The sign will be apparent from the data.)

A perusal of these results will bear out the remarks made earlier concerning the accuracy of the approximations. It is a simple matter to extend the method to estimate second order and higher order differentials, but these are of more interest to the analyst than to the engineer.

High Sensitivity Wattmeters

OPENING a Measurements Section discussion recently at the Institution of Electrical Engineers on high sensitivity wattmeters, Dr. A. H. M. Arnold (N.P.L.) said that to increase sensitivity above that requisite to secure a readability of 0·1 per cent of full scale deflection offered little advantage unless it improved accuracy or allowed measurement of small powers. The practical lower limit of a wattmeter range was reached when the current taken by the voltage transformer or the voltage drop across the current transformer primary became excessive. The measurement of small powers therefore necessitated reducing the insertion loss of the instrument with its auxiliaries.

Two approaches were possible. One method was to reduce the VA consumption of the instrument, as exemplified for dynamometers by the use of ferromagnetic material for as much of the magnetic circuit as possible, by reducing the controlling torque necessary (suspended movement and mirror with external light source to indicate deflection) and by improving the optical system to allow greater precision in reading a given deflection. The second method was to supply the operating power for the wattmeter from an independent source, preferably by employing an electronic feedback amplifier. The best accuracy for d.c. power measurements was 0·02 per cent and was less for a.c. wattmeters having sensitivities approaching 0·01 per cent of full scale. Considerable difficulty was found in securing an accuracy better than 0·1 per cent, corresponding to the readability of a normal 6in wattmeter.

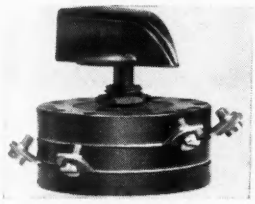
Perhaps the most important limitation to accuracy of comparison, Dr. Arnold said, was unsteadiness of supply, but improvements were being made through automatic control of rotating machinery or generating supplies electronically. The next most important limitation was fatigue of the control spring or suspension and friction of pivots. Other sources of error discussed were scale imperfections, particularly near zero, and temperature coefficients and self-heating effects. The new nickel-chromium-aluminium alloys promised well and good results could often be obtained by a mixture of two wires with coefficients of opposite signs. Errors from suspension fatigue and scale imperfections had been almost eliminated in the Hawkes-Shotter comparator, a double null instrument, which became increasingly satisfactory as stability of supply was improved. Its accuracy was 0·05 per cent.

Summing up the position, Dr. Arnold said a number of commercial wattmeters were now available with sensitivities from 0·05 to 0·01 per cent of full scale deflection or its equivalent for null instruments.

NEW ELECTRICAL EQUIPMENT

Multi-Way Rotary Switch

A NEW AND competitively-priced rotary switch of moulded construction has just been put on the market by CRATER PRODUCTS, LTD., The Lye,



Crater multi-way rotary switch

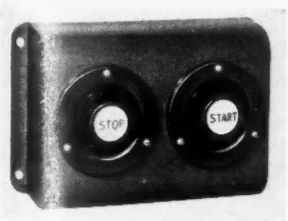
St. Johns, Woking, Surrey. It is liberally rated at 5 A 250 V and can control any number of poles with an almost unlimited selection of circuit combinations up to 12-way, yet the body diameter is only 1⅝in. Among other features, the switch has a very low contact resistance and can be supplied with a variety of fixing terminals.

Push-Button Switches

A simple time delay push-button "stop-start" switch has been developed by HAMPSON INDUSTRIES, LTD., West Bromwich, to control diesel and petrol driven generating plant. It enables time delays from 5 sec up to 2 min to be obtained without the use of relays. One button is marked "start" and when depressed it connects the starter motor to the battery long enough to enable the engine to start, after which time the button automatically returns to its original position. The "stop" button automatically actuates a stopping device on the engine (for periods of up to 1 min) until the engine has stopped.

The centre floating portion of each switch, when depressed, compresses a phosphor-bronze spiral and removes the air from a cylindrical dash-pot, at the same time operating a hinged brass snap action contact which is carried against spring tension into electrical connection with two fixed contacts, so completing the starting circuit. The speed (or time delay) with which the centre floating body returns to its original position can be governed by an adjustable needle valve in the dash-pot head, so that any particular setting can be determined. A further refinement is the inclusion of a pilot air hole in the Bakelite housing, which allows extra air to rush into the dash-pot as the piston returns to its decompressed position, thus forcing the hinged electrical contact to break swiftly and cleanly.

Hampson generating set push-button control switch



This control (Patent No. 28030) has become an integral part of the Hampson remote control system.

Infant Feeding Outfit

The "Stuart" electrically heated infant feeding outfit now being manufactured by THE CHURN CO., Station Road, Hailsham, Sussex, can also be used as an airer for napkins or a nursery heater.

There are two heating elements; one is a quick boiling ring (450 W) for use with the jug, supplied for sterilization purposes, and the second (150 W)

"Stuart" infant feeding unit

is wound round one of the three recesses which hold the feeding bottles. It takes 3–5 min to heat the milk in the bottle to the correct temperature for feeding purposes.

The lid of the heater can also be used for washing the bottles and jug after use. The retail price, complete with two spare bottles, is £4 15s.

Flashing Direction Indicators

Flashing direction indicators are now legal on all cars in Great Britain and the BRITISH THOMSON-HOUSTON CO., LTD., is making a range of "Mazda" lamps suitable for this duty. After passing rigorous shock and vibration tests these lamps are now being made at the company's lamp works at Leicester.

Most popular of the new systems is expected to be the one using four twin-filament lamps, one at each "corner" of the car, in the normal side-light and rear-light fittings. The 12 V lamp contains a 6 W and an 18 W filaments and may be used either as a side-light combined with a much brighter flashing indicator, or as a rear-light with the bright filament used for both stop-light and flashing indicator. This lamp may be so wired that the flashing system has over-riding control over the stop-light system. The filament of the new flashing lamp is said to give at least six times as much light as the lamps normally used in the traditional British semaphore traffic indicator.

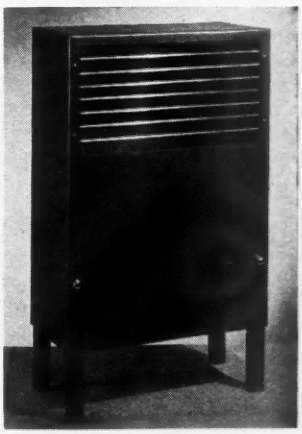
The lamp filaments are mounted transversely, and optically adjusted for light centre length and for axiality in relation to the lamp cap which has offset pins to ensure that the lamp is correctly positioned in the socket. The filaments are mounted on four wires (instead of three and a support) to ensure symmetry of vibration. A special method of fixing the filaments to the leads by a shock, vibration and heat-resistant pressing is also used.

Space Heaters

A range of three new space heaters has been announced by CREASEY & Co., 1 and 2, Regent Square, London, W.C.1. The 500 W model measures 19½in in height by 11½in wide by 6in deep and the 1 kW model 19½in by 17½in by 6in. The latter is fitted with a switch for cutting out half the heating element. The largest unit has a loading of 2 kW and two switches enable this to be reduced to 1½ kW, 1 kW or 500 W. All models have a bronzed finish and are fitted with legs, but if required for wall mounting they can be obtained with brackets instead.

The prices of the 500 W and 1 kW heaters are £3, plus £1 2s 6d purchase tax in the United Kingdom, and £4 10s, plus £1 13s 9d purchase tax, respectively, that of the 2 kW model being available on application.

The Creasey 500 W convection heater



VIEWS on the NEWS

By REFLECTOR

IT is difficult for the non-engineering Press and public to appreciate fully the distinction between the various grades of people in the engineering industries. For instance, all the members of the Amalgamated Engineering Union are "engineers" to the lay Press and it is impossible to get it to think otherwise. In references to the electrical engineering industry, particularly the "supply" branch, the same confusion exists. Mr. A. M. F. Palmer, M.P., of the Electrical Power Engineers' Association, chides the *Economist* for describing, in a recent note, the members of his Association as "technicians." He points out that the membership is, in fact, made up of "professional engineers and technologists." It is possibly a misconception of their status and functions that has led to the worsening of the position of the technologist in the supply industry in relation to the administrative and clerical grades which Mr. Palmer mentions in his letter. But I would ask: Are *all* the members of the E.P.E.A. strictly professional engineers and technologists? And is it derogatory to call at least some of them technicians?

* * *

Praise for the British Electricity Authority from the *Sunday Express* is very surprising. In its last issue that newspaper says that Lord Citrine and his principal executives imposed a rule on themselves that they would never switch on electric fires while power cuts were operating anywhere in Britain. Instead they would work at their desks in their overcoats. Fortunately there has been no need for this self-sacrifice during the recent cold weather and the *Sunday Express*, with welcome and unusual generosity, says:—

> "Give credit to Lord Citrine and his B.E.A. for their achievement. Here at least is one nationalized industry that serves the nation well."

* * *

In the same issue of the *Sunday Express* a reader suggests that electric fires operated by a penny-in-the-slot device should be provided in railway waiting rooms. There is certainly a crying need for something of the sort in the majority of these rooms but surely it should be part of the railway's service. I must say that B.R. does sometimes think of its freezing passengers. One cold night last week I had half-an-hour's wait at Clapham Junction and found in one of the waiting rooms a gas fire which immediately overcame any prejudices resulting from my electrical upbringing. But I still cannot understand why the Southern Region, which probably has the finest electrified system in the world, still uses so much gas, even for lighting.

* * *

Further letters on the subject of electrical appliances have appeared in *The Times*. On the whole they seem to evince a different view from the original complainant to whom I referred last week. Mrs. I. M. White, who modestly describes herself as "merely a housewife," says that her own experience, and that of her friends, has given her the greatest confidence in the quality of post-war electrical appliances. She gives a list of her appliances and says that none has given the slightest trouble. Two points she mentions which are in line with my last week's view: first, the appliances are all of good quality, "since cheap electrical goods are never reliable"; and second, that she looks after them—"they have benefited from careful cleaning, oiling and general home maintenance." It would pay manufacturers to give buyers brief hints on the care of appliances in the form of a small printed slip. Carelessness and ignorance might thus be overcome to some extent.

* * *

Looking through the January issue of the official journal of the Electrical Trades Union I came across the following passage in a report from the Cardiff area:—

> "The electricity supply industry, although nationalized, seems to be bristling with difficulties regarding the interpretation and operation of agreements. Peace in any industry is something that cannot be expected, and if such a state of affairs did prevail it would cause apathy amongst our members, resulting in a marked effect on trade union activities."

If this means anything at all it suggests that to keep trade unions going (or to keep trade union officials in their jobs) there must be constant conflict between employers and employees in any industry. It casts a vivid light upon the present dispute in the electrical contracting industry. This sort of statement gives some justification for the epithet "Communist controlled" which many newspapers prefix to the Electrical Trades Union.

* * *

I was surprised to learn at the annual conference of electrical housecraft advisers and demonstrators last week of the conditions under which some—I hope not many—have to work. Apparently there are districts in which there are no service centre facilities for demonstration at all, while in others water has to be brought long distances by bucket and even gas has to be used for heating water. How demonstrators can be expected to perform their duties efficiently in such circumstances I don't know. While the "higher-ups" must bear some responsibility for this state of affairs I am inclined to think that the matter does to some extent lie in the hands of the demonstrators, who should agitate persistently until their justifiable requirements are forthcoming.

* * *

The latest instalment of my fish serial comes from the *Birmingham Mail*. Some time ago I reported that the North of Scotland Hydro-Electric Board decided to protect the trout in Loch Luichart, Ross-shire, by eliminating the pike which infested the lake; it did this by means of explosives. Now, in the *Mail*, a writer says he has never heard of anything so disgusting in the world of angling before, and wishes that members of the Board could be hoist on their own petard. He is angry because "pike, perch, roach, chub—in a word all the fish dear to the average Midland angler—are being done away with in the interest of trout fishing." He might try to get a new clause added to the Electricity Reorganization (Scotland) Bill to prevent future repetitions of the Board's explosive methods.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Mr. **Michael Parkinson,** M.A., has been appointed general manager of the Guiseley Works of Crompton Parkinson, Ltd. Mr. Parkinson, who is twenty-six, is a nephew of the late Mr. Frank Parkinson and joined Crompton Parkinson, Ltd., in 1950 as a trainee in the production and other engineering departments. In 1951 he was a

Mr. M. Parkinson

member of the Crompton Parkinson Productivity Team which visited the United States and, at the conclusion of the tour, he remained for a further period of special service in the United States and Canada. He recently visited Crompton Parkinson factories in Australia and South Africa. Since his return Mr. Parkinson has been at Guiseley gaining practical experience. He is assistant to the works director north, and will retain the position. Mr. Parkinson was co-opted to the board of directors in 1953, after serving on the junior board from March, 1952. Before joining the company, Mr. Parkinson obtained an honours degree, Mechanical Sciences Tripos, at Cambridge, and from 1948 to 1950 held a commission in the R.E.M.E.

All the living past-presidents of the Northampton Engineering College Past Students' Association ("The Old N'Ions") have subscribed to provide a badge of office for the president for

Mr. H. G. Jenkins presenting the "Old N'Ions" presidential badge to Mr. J. Mortimer Hawkins

the time being. The first presentation of the badge was made recently to **Mr. J. Mortimer Hawkins** by the Association's first president, Mr. H. G. Jenkins, who occupied that office in 1909. The hon. secretary, Mr. R.W. C. Gilbert, 6, Ella Road, London, N.8, will be glad to hear from any past students who are not already members of the Association.

Mr. W. Angus Macfarlane, Ph.D., of the Department of Scientific and Industrial Research and at present director of the United Kingdom Scientific Mission in North America, has been appointed general manager of the recently formed National Industrial Fuel Efficiency Service. He will take up his new duties in March. Meanwhile arrangements for the transfer of certain of the staffs from the Ministry of Fuel and Power will be taking place, and other organizational details attended to. After graduating at Balliol Dr. Macfarlane spent two years

Dr. W. A. Macfarlane

at the University of California, gaining the Ph.D. degree. He joined the Fuel Research Station of the Department of Scientific and Industrial Research from which he took up an appointment with the L.M.S. Railway under Sir Harold Hartley as senior chemist. Later he joined the Ministry of Fuel and Power in which he became the first director of fuel efficiency. This position he held until 1948 when he became director of the United Kingdom Scientific Mission in North America and Attaché for Scientific Questions at the British Embassy, Washington.

The Minister of Fuel and Power has reappointed **Sir George Gater,** G.C.M.G., K.C.B., D.S.O., J.P., as a part-time member of the London Electricity Board.

At the annual dinner and dance of H. D. Symons & Co., Ltd., on 22nd January, **Mr. H. D. Symons** was presented by the employees with a silver cigarette box and lighter to mark the completion of his thirty-five years as managing director of the company. Mr. Symons, who is a founder of the company, has assumed the chairmanship and his son, **Mr. M. D. Symons,** has succeeded him as managing director.

Mr. H. D. Symons (left), receiving from Mr. G. W. Wadsworth a presentation from employees of H. D. Symons and Co., Ltd.

Major H. J. Bullard, M.B.E., A.M.I.E.E., Assoc.I.Mech.E., senior mechanical and electrical engineer, Salisbury Municipal Electricity Department, Southern Rhodesia, has been appointed generation engineer in charge of the undertaking's power stations. He informs us that he will be visiting the United Kingdom for three months on business in June of this year, and his accommodation address will be Rhodesia House, Strand, London, W.C.2.

Mr. H. Greenwood, for nearly four years superintendent of Agecroft generating station, Pendlebury, has been appointed superintendent of the new Drakelow power station, Burton-on-Trent. He took over his new duties on 1st February and will superintend the commissioning of the first of the station's transformers. As we have already reported, Mr. Greenwood's successor at Agecroft is **Mr. W. J. Henton-Jones.**

Mr. R. B. Whitelaw, A.M.I.Struct.E., has been appointed a senior assistant engineer (civil) in the London Division of the British Electricity Authority. Mr. Whitelaw joined the London Power Co., Ltd., in 1938 from Sir Wm. Arrol & Co., Ltd., and after vesting date became a second assistant engineer in the Chief Generation Engineer's (C) Department of the Division.

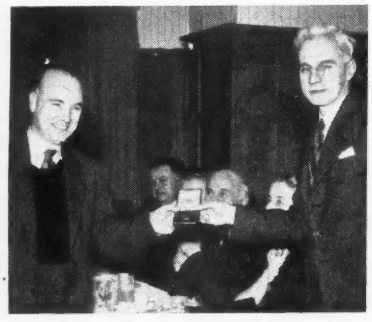
The annual dinner of the **Elliott Long Service Association** (Elliott Brothers (London), Ltd.), was held at Pynes Restaurant, New Cross, S.E., with the president of the Association, Mr. W. Phillips (fifty-seven years'

service) in the chair. The toast of the company was proposed by Mr. C. M. Hopwood and in his response Mr. L. Bagrit, managing director, drew special attention to the recent Government White Paper on the employment of older persons. This question was one to which serious consideration should be given in the interests of the nation. Mr. L. W. Pettitt proposed the toast to the president of the Association, and Mr. Phillips replied.

The **North of Scotland Hydro-Electric Board** held a ball at the Assembly Rooms, Edinburgh, on 28th January. Included in the accompanying picture are Sir George and Lady McGlashan, Mr. N. S. Beaton and daughter (Mrs. Martin), Mr., Mrs. and Miss Lawrie, Sir William and Lady Milne, and Mr. W. D. D. Fenton.

Mr. F. E. London, now representing Venner, Ltd., in the Yorkshire and North Eastern Electricity Boards' areas, has set up residence at 21, Penleys Grove Street, York (telephone: York 53464).

The **Tuscan Engineering Co., Ltd.,** Bridgend, celebrated its twenty-first birthday at a dinner and dance held at the Esplanade Hotel, Porthcawl, on 9th January. Directors, officials and members of the staff, with their relatives and friends attended. Speeches were made by Mr. G. I. Payne, managing director, Mr. F. I. Payne, director, and Mr. Dennis Morgan, Board of Trade. Mr. Payne presented Mr. Joe Murray, B.E.M., with a gold pocket watch to mark his twenty years' service with the company, and on behalf of the employees and staff Mr. Murray presented Mr. Payne with a gold wristlet watch.



Mr. J. Murray (left) receiving a gold watch from Mr. G. I. Payne at the coming-of-age dinner-dance of the Tuscan Engineering Co., Ltd.

Mr. G. W. Gibson, managing director of Fry's Metal Foundries, Ltd., was presented by his fellow directors with a silver salver on 7th January to mark his completion of forty years with the organization.

Mr. John Gray has been appointed managing director of Brentford Transformers, Ltd.

Officials of the North of Scotland Hydro-Electric Board, with their ladies, at a ball held in Edinburgh

Proposing the toast of "The Electricity Supply Industry" at a dinner and dance recently held by the Cornwall Sub-Area of the **South Western Electricity Board,** Mr. C. J. Hocking, Cornwall Sub-Area manager, spoke of the fine spirit of service which exists in the industry. As an example, he referred to the previous night when employees had worked in a blizzard to restore supplies. Responding to the toast, Mr. Harold Midgley, deputy chairman of the South Western Board, spoke of the remarkable progress of the industry in the past seventy-five years. A few days earlier he had made a presentation to the 100,000th consumer connected in the Cornwall Sub-Area. The South Western Board had taken over an area less than one-third of which had an electricity supply, and had added 120,000 consumers and more than 5,000 farms.

The Sports Club of **Siemens Brothers & Co., Ltd.,** Woolwich, presented the Siemens Players in "Madam Tic-Tac" by Falkland L. Cary and Philip Weathers at the Sports Club Hall in Charlton Park Lane on 16th and 23rd January. The audiences included Mr. W. E. Goodwin, manager, Telecommunications Group, Mr. W. T. Pope, labour manager, and Mr. F. W. H. Shaw, manager and chief engineer, Cable Branch.

OBITUARY

Mr. M. M. Wyatt.—The death occurred on 25th January at Basingstoke Hospital of Mr. M. Montague Wyatt, A.M.I.E.E., formerly with the London Electricity Board. Mr. Wyatt was educated at Seafield Park Engineering College, Fareham, Hants, and Charterhouse School, Godalming, Surrey. He received his practical training at Deptford power station, after which he held various appointments with the London Electric Supply Corporation, Ltd., with whom he was deputy engineer from 1935 to 1948. On nationalization he became acting local manager, Southern Sub-Area, London Electricity Board, and from 1949 until his retirement from the Board in 1951 was engaged on special duties.

Mr. G. E. Taylor.—The death occurred in Johannesburg on 18th January of Mr. G. E. Taylor, A.M.I.E.E., who retired from the position of technical investigation officer (electrical), London Transport, last November. Mr. Taylor started his career with the Newcastle-on-Tyne Electrical Supply Co., Ltd., and joined the Metropolitan Railway in 1919 as a draughtsman. He was sub-station and supplies engineer until 1950 when he was appointed technical investigation officer and was made responsible to the chief electrical engineer for all technical investigations and developments, including the work of the testing section.

Major E. H. Armstrong.—"The Times" New York Correspondent reports that Major Edwin Howard Armstrong, credited with the invention of frequency modulated radio in 1935 and a recipient of the Medal of Merit and a presidential citation for contributions to military radio communications in 1947, died on Monday after a fall from his thirteenth floor New York apartment. Born in 1890, Major Armstrong graduated in electrical engineering from Columbia University in 1913 and had worked there ever since, becoming a professor in 1934. Among his important inventions in the radio field were the regenerative circuit which supplied the crystal detector system; the superheterodyne circuit; frequency modulation and the multiplex system, permitting the transmission of more than one programme on the same wavelength.

Mr. **Christopher Wade,** A.M.I.E.E., a director of Gabriel, Wade & English, Ltd., died on 1st February, at Bedford, at the age of seventy-three. Mr. Wade was educated at Harrow, and from 1910 to 1920 was managing director of Richard Wade, Sons & Co., Ltd., and in 1921 became a director of Gabriel, Wade & English. He was the originator and author of "Wade's Tables" in 1907-08, giving the strength of wooden poles for overhead electrical transmission lines, and he was also the author of several papers on this subject read before the Institution of Electrical Engineers.

WILLS

Mr. S. H. Heywood, founder and chairman of S. H. Heywood & Co., Ltd., who died on 24th November, left £70,244 gross (£68,347 net).

Mr. F. D. G. Napier, M.I.E.E., of Offham, West Malling, who died on 25th August, left £1,115 gross (£1,050 net).

Mr. H. G. Morrish, M.A., late a director of Chapman, Lowry & Puttick, Ltd., etc., died on 18th October, leaving £135,318 gross (£131,162 net).

Mr. H. J. Hodges, formerly chief labour officer to W. T. Henley's Telegraph Works Co., Ltd., who died on 10th September, left £10,183 gross (£10,132 net).

Mr. R. C. Walker, A.M.I.E.E., A.M.I.Mech.E., late research worker and lecturer at the General Electric Co., Ltd., who died on 7th August, left £7,916 gross (£7,850 net).

Mr. J. E. Taylor, M.I.E.E., retired superintending engineer, G.P.O., who died on 21st August, left £9,070 gross (£8,952 net).

Mr. A. H. Wynn, a director of Barbados Electric Supply Corporation, Ltd., who died on 28th August, left £87,720 gross (£81,052 net).

Mr. D. P. Gilbert, A.M.I.E.E., former assistant staff engineer, G.P.O., who died on 15th September last, left £17,500 gross (£17,348 net).

Mr. D. A. MacKay, of 17, Manor View, Church End, Finchley, N.3, electrical engineer, who died on 2nd September last, left £21,360 gross (£21,188 net).

Mr. W. A. Jackson, O.B.E., M.I.E.E., a director of the Telephone Manufacturing Co., Ltd., who died on 25th October last, left £22,489 gross (£22,366 net).

Mr. R. H. Lawson, director of Electric Scaling Hammers, Ltd., etc., who died on 24th September, left £10,048 gross (£9,915 net).

Mr. J. T. Bailey, Sao Pedro de Estoril, Portugal, power station superintendent, who died on 3rd June last, left estate in Great Britain valued at £15,689.

SPEEDIER POLE ERECTION

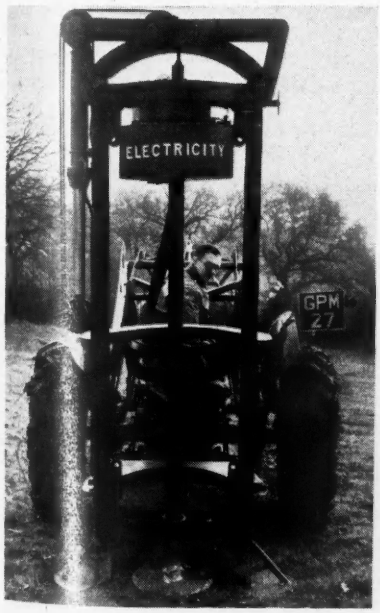
THE erection of overhead lines for electricity supply extension work presents many difficulties and usually the use of heavy machines to assist in this work is out of the question, due to the unevenness of the ground to be found along the banks of streams or in hedgerows typical of the route for normal rural distribution.

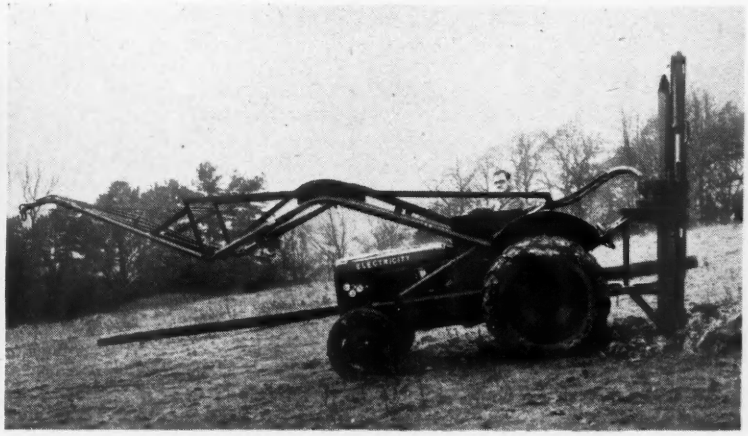
Mr. J. V. Taylor of Taymen, Ltd., Woodland Way, Kingswood, Surrey, and the South Eastern Electricity Board and as a result they have collaborated with him in designing the "Taymen" earth borer to deal with this problem. This machine, for which patents are pending, was recently demonstrated at the Surrey Sub-Area headquarters of the South Eastern Electricity Board, Dorking.

The outfit consists of a standard tractor, to which the actual hole boring device is fitted, and power is derived from the tractor engine through a flexible pipe to the hydraulic geared power unit mounted at the top of the boring shaft. In normal soil a hole measuring 18in diameter and 6ft 6in deep can be made in approximately 12 minutes, the speed of the auger being 55 r.p.m. It is also capable of boring holes up to 2ft in diameter by fixing larger cutting heads. In the event of stone or solid rock being encountered, a safety valve in the hydraulic unit comes into operation preventing damage to the driving shaft. It satisfactorily lifts poles, complete with ironwork and insulators, up to 36ft in length to a height of 20ft and a safety load of 6½ cwt has been approved by the insurance companies.

As an indication of the capabilities of the machine, it is estimated that it will erect three times the number of poles with a team of three men as were previously erected by six men, and the time taken to put up one pole is just half-an-hour.

The "Taymen" hole borer has been approved by the South Eastern Electricity Board and the machine demonstrated is actually in use by them. It was pointed out by Mr. L. Fisher, Surrey Sub-Area Engineer, that whereas formerly farmers were reluctant to allow the use of heavy machinery on their land, they were now quite willing to co-operate with the tractor crew. The price of the borer is £398, plus £136 for the loader complete with safety devices.





Rear view of the "Taymen" earth borer and (right) hole boring in progress; it will be noted that despite the sloping ground the boring shaft is in a vertical position ("Seeboard" photographs)

Corrosion of Grid Conductors

Discussion on I.E.E. Paper

THE discussion of the paper entitled " Service Experience of the Effect of Corrosion on Steel-Cored-Aluminium Overhead-Line Conductors " by Dr. J. S. Forrest and Mr. J. M. Ward, which was presented before the Institution of Electrical Engineers and summarized last week in the *Electrical Review*, was opened by Mr. P. J. Ryle (Merz & McLellan). Referring to the estimate of 50 years as the life of conductors in clean areas, he said this information would be of particular interest to the Colonies or parts of the Commonwealth remote from the coast and from industrial pollution. It was, he said, satisfactory that the steel core was not the weak point, as was believed when the early grid specification was under consideration. With the worst corrosion, even when the zinc had gone, the steel core was still a reliable mechanical part of the conductor. Earth conductors had a longer life than line conductors in spite of having, on the main grid, only one as compared with two layers of aluminium. The reason was that being " dead " they did not collect the products of atmospheric pollution to the same extent. Really pure aluminium was one of the best materials for not exhibiting corrosion, and the aluminium in s.c.a. conductors had a purity of about 99·5 per cent. This was not specified in B.S. 215, but the specified conductivity ensured a purity of about that figure. It would be interesting to speculate on whether a purity of 99·9 per cent for bad areas, if it could be specified, would justify the probable extra cost of production.

Effect of Aluminium Alloys

Dr. U. R. Evans (Cambridge University), referring to the behaviour of aluminium in contact with steel, suggested that if analogous information were available about the behaviour of aluminium alloys used in structural engineering and in aircraft in contact with steel, a lot of trouble would be saved. Perhaps the most interesting outcome of the authors' laboratory tests was that when the zinc corroded a small amount of iron went into solution, changing the polarity. Probably (as borne out by experiments elsewhere) this iron was deposited on the aluminium not as metallic iron but as magnetite. If so, dangerous corrosion could occur. If this small amount of iron could be prevented from being redeposited, one might get a better life. For this purpose, zinc spraying of the whole conductor might be considered, or if this was too expensive or if the aggregate was felt to be unsuitable, zinc-rich pastes might offer a solution. The histogram was not the best method of using statistical data, as much valuable information was thereby thrown away.

Mr. E. W. Skerrey (British Aluminium Company), speaking on behalf of Dr. F. A. Champion and himself, suggested that the authors should take into account the severity as well as the type of corrosion. This would give four classes instead of two (coastal versus the rest) which in descending order of severity of attack would be industrial-marine, marine, industrial, and rural. Greases for use inside the conductor should have high adhesion and low cohesion to ensure the retention of the grease film on all metal surfaces, but the authors appeared to prefer low cohesion only for external greasing. They appeared to regard plastics as unsuitable, but had they considered a plastic skin to coat the conductor completely? Admittedly this might not be an economic proposition.

Mr. H. R. Schofield (B.E.A.) said that at present the practice was to use conductors with the full impregnation but no cover overall, which in one case had caused considerable trouble in erection. It collected foreign bodies and blocked up the running-out blocks, and it was doubtful whether much grease was left in some places. Again, grease was apt to drop off in hot weather.

Mr. W. J. Nicholls (Aluminium Wire & Cable Co.) doubted whether the number of samples in the 1949/52 series was sufficient for statistical analysis. More important, he said, was the question whether these samples were representative of conductors all over the country.

Mr. R. C. Brown (J. L. Eve Construction Co., Ltd.) said that in his experience greasing was unsatisfactory; Dr. Evans' remarks about zinc spraying were, therefore, very interesting.

Experience in France

M. Herenguel (who spoke in French) said that tests in France had shown the importance of the quality of the zinc. Some conductors contained chloride arising, no doubt, during manufacture. This caused marked corrosion. Apart from this, the results were very satisfactory. Climate was undoubtedly important. Conductors on the Mediterranean were in an excellent state of preservation after fifteen years' exposure, but the further north one went the worse they became. Greasing effectively protected aluminium strands.

Mr. A. M. Evans (Shell Petroleum Co.) said that in general grease gave very good protection. There was an optimum film thickness which would resist flow or drainage. The great need was for a material that was fluid when heated and yet would not lose its properties. From some points of view grease might not be ideal, but it had great advantages and its use would probably be extended in this country and overseas.

Mr. W. G. Hawley (B.I.C.C.) suggested, as an alternative to greasing, putting an aluminium sheath over the whole of the conductor.

Mr. J. C. Tucker (Aluminium Laboratories Ltd.) said that, in view of the variety of atmospheres in this country, wide differences must be expected in the behaviour of conductors.

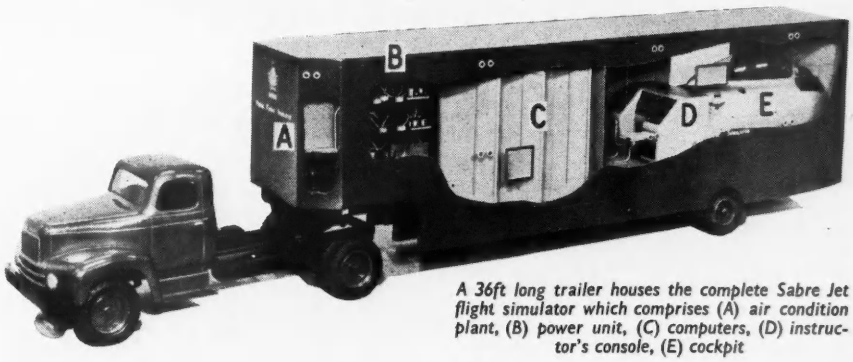
Mr. B. Donkin (Kennedy & Donkin) suggested that the real criterion of conductor deterioration was not the average condition over a length of cable but the condition at the worst point. Similarly, what mattered was the rate of deterioration of conductors which were deteriorating very rapidly and not mean values.

Mr. C. A. Morton confirmed that electrolytic corrosion was more marked in coastal regions, although it did occur in industrial situations owing to local conditions, for instance, the vicinity of chemical works. The best method of combating corrosion was suitable greasing.

Mr. J. C. Bailey (Aluminium Development Association), although in favour of greasing conductor interiors, saw little advantage in coating the exterior, since it would afford protection for only three or four years. He hoped the authors would continue their work so as to check their forecasts against actual experience.

Mr. P. Robinson (Kennedy & Donkin) suggested that the saving on greased conductor, though appreciable, would not be so great as the authors estimated taking into account interest and depreciation.

Aircraft Flight Simulator



A 36ft long trailer houses the complete Sabre Jet flight simulator which comprises (A) air condition plant, (B) power unit, (C) computers, (D) instructor's console, (E) cockpit

Equipment for the Canadian Government

IN July, 1952, a $3·5 million contract to build ten Sabre Jet flight simulators for the Canadian Department of Defence Production was awarded to Redifon, Ltd., in spite of keen American competition. Delivery was stipulated within eighteen months and last week Air Vice-Marshal Hugh Lester Campbell, C.B.E., Air Officer Commanding the Royal Canadian Air Force in Western Europe, accepted delivery of the first simulator from Mr. Paul Adorian, chairman of Redifon, Ltd.

The simulator consists basically of a replica of the Sabre cockpit, together with control panels and recorders for the instructor and the computing equipment in a trailer and it has an independent mobile power generator.

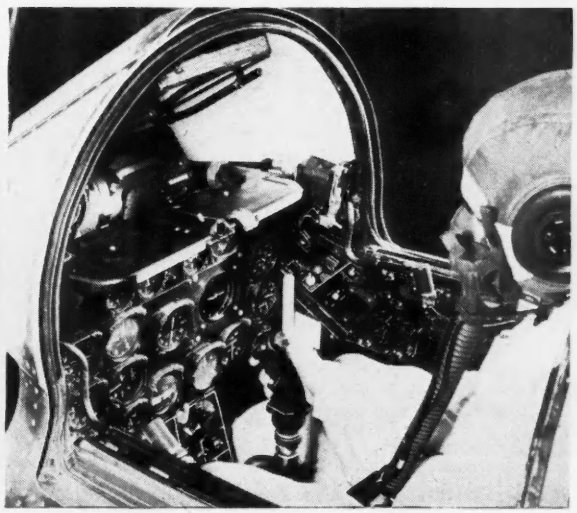
Practically any navigational problem or emergency condition can be presented to the trainee pilot. These problems and the normal conditions of flight are translated by an analogue computer into instrument readings and control responses. The pilot's handling of the controls and equipment produces the same results in the simulator as would be experienced in an aircraft—without any of the hazard and at a fraction of the cost of actual flight.

It is thus possible to feed emergency conditions into the simulator—conditions which with a student pilot might, in the air, easily lead to disaster. Appropriate aural effects and correct feel of all controls are examples of the faithfulness of simulation. In fact, the only impressions which are not given are the physical effect of acceleration and the external view through the canopy.

When the simulator is in operation, signals originating from the controls are fed through valve amplifiers to actuate a number of interconnected electro-mechanical servo units which form the analogue computers. The servo units are reversible motor-driven integrators or position controlled devices carrying assemblies of potentiometers, with windings contoured to produce various voltage functions. The voltages are combined to interrelate the computing servos and thereby solve the appropriate equations. Every movement of the elevator, ailerons, flaps, rudder and throttle is translated into the reading of the airspeed, rate of climb, rate of turn, pitch and roll instruments in the cockpit. Throttle adjustment results in appropriate variations in the simulated engine noises which also vary with airspeed. Gunfire and brake squeal are examples of other noises generated.

A large number of failures and effects can be fed in from the instructor's console, including fires in various zones of the aircraft; failure of supplies; flight instrument failures; hydraulic failures; undercarriage faults and errors in all engine and fuel system instruments. The radio aid equipment on the console and the two recorders give full operation—including failures and deficiencies—of the radio facilities. Each aid is independently adjustable for different transmitter locations. The large area recorder produces d.f. facilities and is electrically coupled to the small area unit to switch in automatically the small area charts.

Left: Instructor's console for the Redifon Sabre Jet flight simulator showing the repeated cockpit instruments and controls for feeding the conditions, problems and emergencies into the apparatus. Right: The cockpit of the simulator is a faithful reproduction of that in the aircraft



PARLIAMENTARY REPORT

MR. GEOFFREY LLOYD, the Minister of Fuel and Power, has introduced the Civil Defence (Electricity Undertakings) Bill, to enable Treasury grants to be made in respect of measures taken to secure the due functioning of electricity undertakings in Great Britain in the event of hostile attack. It is estimated that in the financial year 1954–55 the grants will amount to £1,200,000.

Television from Abroad

In the House of Commons last week Colonel Ralph Clarke asked the Assistant Postmaster General what negotiations foreign television authorities had had with him with a view to making possible direct television broadcasts to this country from the Continent.

Mr. Gammans said they had had none. He could not see direct service from the Continent coming for some time.

Television Development

The Assistant Postmaster General informed Mr. C. I. Orr-Ewing and Mr. Fell that the six proposed television stations would operate in Band I, i.e. between 41 and 68 Mc/s. The power to be radiated from the permanent station near Norwich would vary with the direction of radiation, with a probable maximum of 15 kW. The power of the other five stations had still to be determined. Horizontal polarization would be used in each case.

In reply to Mr. Ness Edwards, Mr. Gammans said the B.B.C. estimated that the capital cost of the fourteen television stations now in course of construction or planned would be about £2,300,000. The Corporation's latest proposals for 56 v.h.f. sound broadcasting transmitters would cost some £2,000,000. There would be considerable expenditure by the Post Office for television links.

Answering Mr. Hector Hughes, he said that the permanent station for the Aberdeen area would be at Core Hill and the B.B.C. expected it to be in operation before the end of 1955. The Corporation proposed, however, to put up a temporary low-power station at Redmoss which would serve Aberdeen and a limited area around, and that should be working by the end of 1954.

Replying to Mr. Fell, Mr. Gammans said that the B.B.C. hoped to provide a temporary station within twelve months to serve Norwich and its immediate surroundings. Great Yarmouth would be served by the permanent station, which was expected to be ready by early 1956. He was informed that the B.B.C. had not found it necessary to carry out field tests for this station.

Hessary Tor Site

Mr. Astor asked the Minister of Housing and Local Government if he would now announce a decision about the use of Hessary Tor for a television station.

Mr. Macmillan said he had decided that permission should be granted, subject to certain safeguards.

Frequency Modulation

Mr. Ness Edwards asked how far the Television Advisory Committee's technical committee was limited in its recommendation on the form of modulation to be adopted, by the needs only of the B.B.C., and excluding the need of universities and like bodies to establish very high frequency broadcasting systems.

Mr. Gammans said that the recommendation to adopt frequency modulation applied whether very high frequency broadcasting stations were set up by educational authorities or not.

Sir Ian Fraser asked the Assistant Postmaster General if he would make a statement on the steps the Government proposed to take upon the recent report on v.h.f. radio transmissions and the frequency modulation system.

Mr. C. I. Orr-Ewing inquired if, in view of the fact that the B.B.C.'s present plan to relay existing sound programmes on v.h.f. would cost £3,500,000 of licence money and would cost the public £20 per set if they wished to receive these relays, he would submit the matter to the Television Advisory Committee, or some other expert committee, before coming to a decision.

Mr. Gammans said that the Postmaster General was considering the recommendation of the Television Advisory Committee that frequency modulation should be adopted for v.h.f. sound broadcasting.

Interference from Railway

Sir Ian Fraser asked how far the treatment of a section of the Lancaster-Heysham electric railway to eliminate interference with television reception continued to be satisfactory; and if he would extend the treatment to adjoining sections of the line.

Mr. Gammans said he was glad to be able to say that the treated section of this line continued to be satisfactory. Other sections which caused interference would be similarly treated as soon as possible.

Export of Generating Sets

Mr. Harold Wilson asked the President of the Board of Trade why an export licence was recently refused by his department for the shipment to China of electrical generating sets supplied for use with cinematograph-projection equipment.

Mr. Peter Thorneycroft said that electrical generating sets of all sizes were regarded by Great Britain and her allies as falling within the terms of the United Nations Resolution of May, 1951, and their export to China was accordingly prohibited.

Private Telephone Systems

Mr. Erroll asked the Chancellor of the Exchequer what restrictions were placed on capital expenditure on private telephone systems.

Mr. Reginald Maudling said the reply was "None."

Electrical Contracting Dispute

THE principal feature last week of the dispute between the National Federated Electrical Association and the Electrical Trades Union was the strike of London electricians numbering about 7,000. At the same time the strikes at a number of sities were continued. In a statement on Thursday last week Mr. L. C. Penwill, director and secretary of the N.F.E.A., denied reports that his Association might offer the electricians an increase of 1½d or 2d an hour and reaffirmed his suggestion that an independent arbitrator should deal with the dispute. The Association undertook to abide by any decision that was made by such an arbitrator.

Mr. S. L. M. Barlow, the president of the N.F.E.A., commented upon the situation in a speech at the E.C.A. and Allied Associations' annual dinner on Wednesday last week (reported in this issue).

When the general London strike ended last week-end it was announced that the electricians employed at Olympia would remain on strike.

On Monday last about 1,500 men in South West Lancashire, Cheshire and North Wales began a week's strike.

Union officials claimed that there was "100 per cent" response, but the employers said that some men were working at different sites.

The *Manchester Guardian* reports that shop stewards of the Merseyside branch of the Confederation of Shipbuilding and Engineering Unions and the National Federation of Building Trades Operatives met at Liverpool on Thursday last week and congratulated the E.T.U. on its wages fight. The meeting also decided, by way of support, to ban overtime on Friday night. The *Guardian* adds:—"Hardly any overtime is ever worked on a Friday night."

INDUSTRY AND THE HOUSE

Electricity Reorganization in Scotland

By A. M. F. PALMER, A.M.I.E.E., M.P.

As was generally anticipated the Electricity Reorganization (Scotland) Bill now before Parliament proposes the establishment of an autonomous electricity authority for Southern Scotland with both generation and distribution powers. The new Board, if the Bill becomes law, will be in a position generally similar to that of the North of Scotland Hydro-Electric Board, except that in future the electrical independence of Scotland will be more strongly emphasized, since neither Scottish Board will have representation on the British Electricity Authority.

In the House of Commons the Bill is being treated as a mainly Scottish concern, but it proposes in fact to break down in an arbitrary fashion for a limited part of the United Kingdom not only the basic principle of the 1947 Act, but that of the 1926 (C.E.B.) Act as well. In an attempt to carry out their Scottish election promises the Government are planning a major departure from the long-established policy of treating the wholesale generation and transmission of electricity on a national basis under the control of a United Kingdom Minister. Moreover, the taking of responsibility for Scottish electricity by the Scottish Office does not seem to fit in too well with the recommendations of the Ridley Committee in favour of "top level" co-ordination of fuel and power generally. If the Scots are to have their own electricity why not their own gas and coal as well?

Labour Policy on Scottish Bill

At one stage it was doubtful if the Labour Opposition would divide against the Bill; does not "Home Rule for Scottish Kilowatts" sound electorally attractive? However, on second thoughts the United Kingdom implications of the proposal have probably been seen more clearly and also expert technical arguments against the Bill are said to have impressed the Opposition. Certainly it is not consistent to oppose the break-up of nationalized transport and then tamely accept the dismemberment of nationalized electricity. So, contrary to what might have been thought once, I predict this Bill will now be strongly fought from the Opposition benches.

Of course Conservative supporters will put up an argued case in justification of the Bill. It is known that the North of Scotland Hydro-Electric Board has been impatient of the tutelage of the British Electricity Authority ever since the passing of the 1947 Act, and the views and experiences of Mr. Tom Johnston, chairman of the Hydro-Electric Board, and a former Labour Secretary of State for Scotland, will undoubtedly be called in aid of the Government. Technically it may be argued that the rigid divorce of generation from distribution is an error in any case and that the new arrangement will mean cheaper electricity for Scottish industries. To those of us concerned with the affairs of British electricity, the main debates and particularly the committee stages are likely to be of great interest and a significant pointer to the future.

A minor Bill given a second reading last week was the Development of Inventions Bill. In explaining its purpose Mr. Peter Thorneycroft, President of the Board of Trade, said the Bill extended and slightly amended the Development of Inventions Act, 1948, which had established the National Research Development Corporation. Up to now £750,000 capital had been provided by the Government and the Corporation held some 500 patents at home and 227 overseas. Only a small proportion had reached the final stage when revenue was beginning to come in.

Wider Powers for Developing Inventions

The projects in which the Corporation was interested varied considerably. For instance, there were a large number of inventions connected with the electronic brain, also a potato harvester, a "chick sexer" and a light steam engine. Mr. Thorneycroft suggested that the Bill would enable the Corporation to bring to fruition work already done, and give it wider powers for the future.

The Opposition, through Mr. John Edwards, officially welcomed the Bill from the front bench. Speaking in its support Mr. Austin Albu, the Labour Member for Edmonton, who is untiring in his devotion to parliamentary matters connected with science and industry, pointed out that the main function of the Corporation has been to ensure the development and commercial exploitation of inventions originating in Government establishments, hospitals and universities. In its annual reports the Corporation had shown that there was not a vast number of private inventions at present which could not find development. Mr. Albu thought this contradicted the argument sometimes used that lack of risk capital was holding back the development of new ideas. He conceded that "long shot" inventions and inventions which for final application required really heavy capital expenditure might be retarded, but it did not seem that a great number were lost to industry through lack of capital in the early stages.

Mr. Richard Fort, a Conservative who sits for Clitheroe, dealt with the familiar point that industry is not always interested in developing new inventions for fear that they will disturb vested interests in existing processes. Mr. Fort said that when this charge had been investigated by impartial bodies such as the Swan Committee it had invariably been discovered to be founded on singularly little fact. Far from not wanting to take up inventions industry, which lived by inventions, was "leaning over backwards" to find ideas which it could use and develop.

In his reply for the Government the Parliamentary Secretary to the Board of Trade, Mr. Strauss, answered a question put by Sir Wavell Wakefield on the position of the inventor employed in a government department. If a government servant in the course of his work, said Mr. Strauss, made an invention of substance, the question of reward remained an *ex gratia* matter, but if the invention was exploited commercially some reward to the inventor could be taken for granted.

The employee-inventor has been always, of course, a figure rightly dear to the heart of associations and trade unions looking after the interests of salaried technical staff, and many might think Mr. Strauss's answer a little cold.

INDUSTRIAL NEWS

British Equipment for U.S. Navy

ACCORDING to *The Times* three British companies, the British Thomson-Houston Co., Ltd., Ferranti, Ltd., and the General Electric Co., Ltd., will share an initial order worth $6,500,000 placed by the Hazeltine Electronics Corporation of New York under its off-shore procurement prime contracts with the United States Navy Department. Further orders worth many additional millions of dollars are expected to be placed shortly. The three British companies will manufacture electronic equipment and associated test gear in Great Britain which will be installed in ships and ground stations as part of the North Atlantic Treaty Organization defence system.

Anglo-Japanese Trade

On Friday last the sterling payments agreement between this country and Japan was extended for a further year. The agreement is designed to enable Japan to balance her accounts with Great Britain and it provides for import quotas in respect of various classes of Japanese products. The principal commodities concerned are textile manufactures but the quotas also include electric lamps and lighting appliances to the value of £50,000.

European Productivity Agency

The first year's programme of work of the European Productivity Agency, set up by the Organization for European Economic Co-operation in May, 1953, has been published by the Organization. The programme is divided into six main headings: specific economic and legal problems; technical and administrative problems of industry and commerce; human factors of management and labour; applied research and technology; food and agriculture; and information and general services. Working within the general framework of O.E.E.C., and in conjunction with the Organization's technical committees and other bodies, the E.P.A. will assist National Productivity Centres in the eighteen member countries in their campaigns for industry, commerce and agriculture. These Centres and the E.P.A. between them dispose of an amount equivalent to approximately $117 million, made available under the "Moody Amendment" of the American Economic Co-operation Act and from other sources. It is hoped that by the time the funds are exhausted the Agency will have gained a sufficient measure of confidence from European management and labour, as well as from the National Centres, to ensure governmental support for its continued existence.

The Agency will carry out its programme by collating existing knowledge, and acquiring fresh knowledge; by disseminating or exchanging this knowledge; and by stimulating the necessary action to put it into effect. This will involve among many other activities the organization of working parties and missions, the publication of reports and digests, the organization of training courses, the use of audio-visual aids, and the exchange of workers, specialists and trainers.

Middle East Trade Mission

A meeting was held under the auspices of the London General Export Merchants' Group, at the London Chamber of Commerce on 28th January, when addresses were given by Sir Edward Benthall and other members of the Government sponsored Trade Mission which recently returned from the Middle East. Sir Edward, who was the leader of the Mission, and the other speakers, Major-General Sir Leslie Williams and Mr. S. R. Halton, gave their impressions of the markets and expressed their confidence that, provided British prices were always competitive, there were excellent prospects for this country. It was emphasized, however, that Trade Missions were of no avail unless they were quickly and energetically followed up by individual businessmen themselves and, with this end in view, Sir Edward strongly recommended exporters to visit the Middle East and study the markets and, in particular, to support the Baghdad Trade Fair next October. The meeting was presided over by Mr. R. W. Train.

British Council Radio Courses

Twenty-four courses, with places for 650 overseas specialists, are being organized by the British Council in twenty centres in the United Kingdom during 1954. The courses will run for two to three weeks between March and October at a cost to each member of between £24 and £40. They will include a course on point-to-point radio services, organized in conjunction with the Engineering Department of the British Post Office, which will be held in London.

Radar Contract

Decca Radar Ltd., has been awarded a contract by the Ministry of Supply for a number of Decca 424 airfield control radar sets.

Ultra-Violet Light Exhibition

An exhibition, "Ultra-Violet Light in Industry and Commerce," is being held by Hanovia, Ltd., in conjunction with the Midlands Electricity Board, at the Board's showrooms, 247, Chester Street, Aston, Birmingham, 6, from 15th to 26th February. Among the many exhibits will be a continuous demonstration of the non-destructive crack detection fluorescence unit, a water sterilizer, air sanitizers, many types of ultra-violet analytical and inspection lamps, chromatography and fluorescence microscopy.

Platinum Price Increase

Increased output from the Rustenburg mines in South Africa made it possible, in July, 1950, for Johnson, Matthey & Co., Ltd., to stabilize the price of platinum in the United Kingdom at £27 per ounce troy. The level of working costs has, however, risen appreciably and from 1st February, therefore, the price of platinum has been increased by £3 to £30 per ounce troy.

Tungsten Ore Prices Reduced

The Ministry of Materials has announced that its selling price for tungsten ores of standard 65 per cent grade and ordinary quality have been reduced as follows:—Wolframite from 165s to 145s; Scheelite from 150s to 140s per long ton unit delivered consumers' works.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £156 0s 0d
COPPER, H.C. Electro	ton £221 0s 0d
Fire Refined 99·70%	ton £220 0s 0d
Fire Refined 99·50%	ton £219 0s 0d
COPPER Tubes ..	lb 2s 2½d
Sheet	ton £281 10s 0d
H.C. wire and strip	ton £252 0s 0d
LEAD, English ..	ton £84 15s 0d
Foreign	ton £83 0s 0d
MERCURY	flask £63 0s 0d
TIN, block (English) ..	ton £650 0s 0d
ZINC, G.O.B. Foreign	ton £71 0s 0d
Electrolytic	ton £72 5s 0d
BRASS Tubes (solid drawn)	lb 1s 9½d
Sheet	ton £230 10s 0d
Wire	lb 2s 4½d
PHOSPHOR BRONZE Wire	lb 3s 7½d
PLATINUM	oz £30 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 16⅝d–16¾d

Tyne Tube Railway?

It is understood that Tynemouth Corporation may revive the scheme for the construction of a Kearney tube railway under the Tyne between North and South Shields. The Corporation is being recommended by the Town Improvement Committee to approach Mr. E. W. Chalmers Kearney, who before the war put forward a proposal to construct a tube railway connecting North and South Shields. At that

time both Tynemouth and South Shields Corporations were in favour of building a road tunnel connecting the towns and did not support the tube railway plan. The Ministry of Transport, however, decided that Jarrow, about four miles up river, was a better site for a road tunnel. Nothing further about the Kearney tube railway plan has been heard since then.

Electrical Industries Club

At next Tuesday's luncheon of the Electrical Industries Club (Connaught Rooms, 1 p.m. prompt) the speaker will be Sir Norman Kipping, J.P., M.I.E.E., director-general of the Federation of British Industries.

N.Z. Duty on Vacuum Cleaners

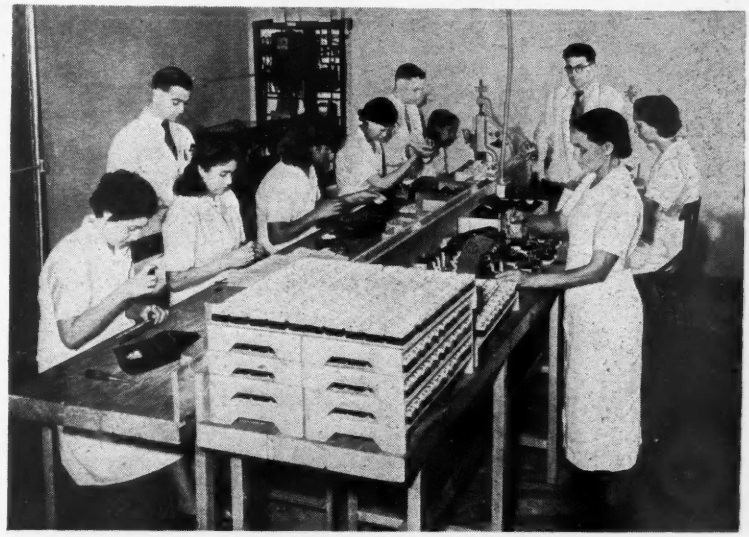
Alterations in the import duty on electric vacuum cleaners were made by the New Zealand Government to take effect from 18th December last. The British preferential rate is now 25 per cent, the most-favoured nation rate 45 per cent, the general rate 60 per cent and Switzerland 45 per cent.

Rolling Mill Equipment Order

The Metropolitan-Vickers Electrical Co., Ltd., has recently received an order for the electrical equipment of a 40in blooming mill at the Cleveland works of Dorman, Long & Co., Ltd. The mill will have a 5,000 h.p. twin-motor drive, one motor being coupled directly to the top mill roll and the other to the bottom roll. This arrangement dispenses with the need for the conventional mill pinion gear box. The equipment comprises two 2,500 h.p. 40/90 r.p.m. motors; a Ward-Leonard motor-generator set comprising two 2,000 kW generators, a 150,000 h.p. sec flywheel and a 4,000 h.p. 11 kV slipring induction motor; a main exciter set; and special quick response auxiliary exciters for use in conjunction with the Ward-Leonard control equipment. The flywheel and induction motor operate in conjunction with an automatic liquid slip regulator in such a way as to reduce the peak loads on the supply system. The main machines are force-ventilated with filtered air to ensure the exclusion of steelworks dust. The control scheme has been specially developed to ensure rapid starting and reversal of the main motors and employs metadyne high response exciters. Provision is made for automatic load limiting, individual speed adjustment of the motors, and voltage compensation on the generators.

Management Conference

In view of the success of last year's Conference for Small Firms, a second one has been arranged from 5th to 7th March next at Ashorne Hill, nr. Leamington Spa. This year the Federation of British Industries has joined the original sponsoring organizations, the British Institute of Management, Midland Region of the National Union of Manufacturers, and the Birmingham Branch of the Institute of Industrial Administration. The subjects chosen cover a wide range of Management subjects, including finance, standardized costing, work study, export marketing and organizational problems caused by expansion. Application forms are available from the conference secretary, British Institute of Management (Room 029), Management House, 8, Hill Street, W.1.



The final assembly department at the new " Diamond H " switch factory at Durban

New Switch Factory at Durban

To meet increasing demand for " Diamond H " controlling devices in the Union of South Africa and also the desire of South African electric cooker manufacturers to purchase locally made switches, a new factory has been established at Durban. Production commenced early in 1953 after the installation of special plant and equipment, carried out under the supervision of English engineers sent out by the parent company, " Diamond H " Switches, Ltd.

Complete manufacturing is now being undertaken and already large quantities of switches have been delivered to most of the important cooker manufacturers in the Union. These switches are of an entirely new design, built on porcelain bases, the type being approved by many South African manufacturers before production was commenced. The switches are compact in appearance and specially designed to meet local requirements covering both installation and wiring. Adequate factory space is available for future expansion.

All the original press tools, jigs and fixtures were designed and manufactured in England, but the new company has now become responsible for the production of additional equipment in South Africa. Complete testing apparatus to S.A.B.S. standards has now been installed and the S.A.B.S. mark has been approved for use on all switches produced. Various types of switch from the same basic design are now being developed and it is anticipated that the production of new oven thermostats will be commenced during 1954. Eventually the company will be responsible for the complete manufacture of all " Diamond H " devices required throughout the African Continent and by certain export markets. These will include rotary switches of all types, toggle switches, snap-in switches and neon pilot lights, also a new range of rotary packet switches.

The English representatives on the board of directors are Mr. C. A. Turner and Mr. E. J. Harris, and the company is being operated in the Union by E. S. Mowat & Sons (Pty.), 51/57, Milne Street, Durban.

Batti-Wallahs' Society

The monthly luncheons of the Batti-Wallahs' Society were resumed last week at the Connaught Rooms, London, after the Christmas " recess," when the principal guest was Vice-Admiral (E) F. T. Mason, C.B., R.N., who spoke on engineering in the Navy.

Vice-Admiral Mason, who is Engineer-in-Chief of the Fleet, said that the great thing which emerged from the war was that the Navy had become research and development minded. Its policy was to reduce the weight and space of machinery, combined with a minimum use of fuel. He thought that steam drive would be used for some time to come, although increasing use was being made of diesel plant.

Speaking of the gas turbine, Vice-Admiral Mason said that it had a future in the Navy, but they had got to go warily. At the moment its use was for boosting and it would be some time before it was used as a

prime mover. Referring to the engineering personnel, he said that there was a falling-off in recruitment of both officers and men, one of the reasons being that at present there was full employment. It was a serious problem and schemes were in hand to halt this falling-off.

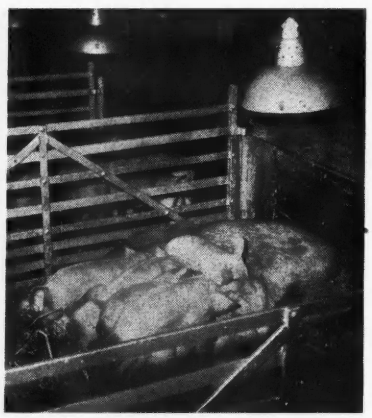
Mr. T. C. F. Bigland (the " Mate "), reminded members of the ladies' night to be held on 17th March and said that tickets were now available. The speaker at the next luncheon of the Society (24th February) would be Mr. Ted Leather, M.P.

Competition for Young Farmers

More than fifty teams from Young Farmers' Clubs in the area of the South Western Electricity Board have been entered for the competition sponsored by Mr. G. H. Johnstone (vice-president of the National Federation of Young Farmers' Clubs). The object of the competition, the first of its kind in this country, is to familiarize young farmers of the future with the economics of electricity on the farm. The clubs' investigations will lead them to a study of electrical methods in agriculture and the ways of reducing labour and fuel costs on the farm. Question papers are being distributed to clubs entering the competition, and teams will study plans and details of an imaginary " prospect farm." They will decide ways and means of obtaining a mains electricity supply and how they will equip the farm and farmhouse to use the supply to best advantage.

Pig Warming in Northern Ireland

Philips infra-red pig farrowing units have recently been installed at the Belfast salesyards of the auction mart of R. J. Allam, Ltd. The company has recently experienced a marked increase in pig turnover, and found it necessary to extend the existing market area devoted to this type of animal. Whereas the market is normally well heated, the proposed extension is high-roofed and draughty and it was evident that some form of artificial heating was essential for the comfort and well-being of the pigs, particularly in-brood sows and litters. The installation, which was carried out by John Dowling & Sons, Ltd., Belfast, comprises thirty-seven 230 V 250 W infra-red lamps. A novel feature of the installation is that the lamps can be lifted out of their normal working position when not in use; this facilitates movement about the pens when cleaning.



Infra-red heating of sows and their litters at Allam's Auction Mart, Belfast

Damages Appeal Dismissed

In March last year at Manchester Assizes Mr. Justice Barry awarded £10,000 damages and costs to the widow of a fireman who received a fatal shock at a Salford pickle factory fire in 1950. Responsibility was apportioned as to 90 per cent against the North Western Electricity Board and 10 per cent against Mayoh & Co., the occupiers of the factory. An appeal by Mayoh & Co. was recently dismissed by the Court of Appeal. Lord Justice Singleton, giving the appeal judgment, said that the main responsibility for the accident lay with the Electricity Board, but he was not satisfied that the Assize Judge was wrong in allocating part of the responsibility for the accident to Mayoh & Co.

Electric Heating for Royal Yacht

E. K. Cole, Ltd., has supplied " Thermovent " marine electric space heating equipment for the new Royal Yacht *Britannia*. The installation, which will heat the staterooms and cabins, comprises 140 separate units of the bulkhead mounting and inset types.

Indian Imports

Details of import licensing arrangements made by the Government of India for the first six months of this year are set out in the *Board of Trade Journal* of 23rd January. From this it is seen that no quota licences will be granted for general lighting service lamps up to 500 W or train lighting and cablight lamps. Licences valid for six months will be granted to established importers and newcomers in respect of fluorescent lamps and to established importers for sealed beam automobile lamps. Licences valid until 30th September will be available for cable accessories and for twelve months in the case of electric control and transmission gear. Newcomers as well as established importers may apply for six-month licences for the importation of complete refrigerators.

Trade Announcements

Ekco-Ensign Electric, Ltd., has appointed Mr. A. Miller as Midlands area manager. He is operating from the Birmingham sales office and depot at 40–42, Summer Row, Birmingham, 3.

British Insulated Callender's Construction Co., Ltd., has moved into new premises at 30, Leicester Square, London, W.C.2 (telephone: Trafalgar 7777). The central administrative offices of the parent company, British Insulated Callender's Cables, Ltd., remain at 21, Bloomsbury Street, London, W.C.1.

The **Dexray Engineering Co., Ltd.,** has transferred its showroom, warehouse and factory to larger premises at 34, Ardwick Green South, Manchester, 13.

H. Cassirer, Ltd., 31, Pinner Road, Harrow, Middlesex, is now packing its household appliances in attractive red and blue cartons of uniform design.

The London office of **Bruce Peebles & Co., Ltd.,** is now at 54, Victoria Street, S.W.1 (telephone: Tate Gallery 3551–4).

A. H. Hunt (Capacitors), Ltd., has announced the formation of Hunt Capacitors (Canada), Ltd. Mr. K. A. Jackson, formerly of the Canadian Marconi Co., has been appointed general manager with Mr. R. A. Grouse of A. H. Hunt (Capacitors), Ltd., as technical director. The new company will manufacture in Ajax, Ontario, capacitors formerly imported from England for the Canadian electrical and industrial markets. The products will be marketed by the Electronic Tube and Components Division of the Canadian Marconi Co., Toronto.

Catalogues and Lists

Electrothermal Engineering, Ltd., 270, Neville Road, London, E.7.—Illustrated leaflet on the new " Solis " lightweight hair dryer (Model 1051).

Gent & Co., Ltd., Faraday Works, Leicester.—Illustrated catalogue of the company's controlled electric clock systems (Book 5 Section 1T).

Simmonds Bros., Stourbridge, Worcs.—Illustrated priced leaflets on the company's earth continuity tester and voltage dropping transformers.

Stella Lamp Co., Ltd., 37–39, Oxford Street, London, W.1.—40-page illustrated and priced catalogue of " Stella " lamps including purchase tax table.

W. T. Henley's Telegraph Works Co., Ltd., of 51 and 53, Hatton Garden, E.C.1.—A leaflet on " Henley " fully impregnated non-draining cables (492).

A. Reyrolle & Company, Ltd., Hebburn, Co. Durham.—Three technical publications on compressed-air equipment for pneumatically-operated Reyrolle switchgear—fully duplicated arrangement (IOMS 378), simplified arrangement (IOMS 408) and unit scheme (IOMS 409).

General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.—" Iron-clad Switchboard Components "—a booklet giving detailed illustrated descriptions of the G.E.C. range of switchboard components together with a scale drawing of a typical switchboard (X.7).

T. B. Morley & Co., Ltd., Jameson Street, Hull.—Two illustrated priced leaflets giving details of the new " TeBeaM " S.12 and S.263 immersion heaters.

Aerialite, Ltd., Castle Works, Stalybridge, Cheshire.—Leaflet illustrating retractable instrument and power cords.

David Brown & Sons (Huddersfield), Ltd., Meltham, Yorks.—80-page illustrated catalogue covering the full range of helical units, turbine gear units and flexible and rigid couplings.

Ivor Power Specialty Co., Ltd., 29, Woburn Place, W.C.1.—An illustrated catalogue of soot blowing equipment for power station boilers.

Engineering in Europe

Abstracts from Foreign Technical Journals

A GENERAL survey of the earthing problem, including the definitions of the Italian regulations for protective and service earths, introduces a detailed description and consideration of the specific development of types of earth electrodes in Italy where soil conditions led to a preference for deep and shallow well-type earths. A lucid diagram of the earth resistances of various soils, rocks and minerals is a useful feature of the section dealing with the calculation of step resistances and contact voltages to be considered in the design of earthing systems.

The main section devoted to modern calculation methods of disciform, hemispherical and rod-type earths, and also considering buried meshworks, follows the well-known lines. The use of these principles in the design of a modern earthing system is exemplified in great detail on the system of the power station S. Massenza in which full advantage was taken of the presence of the lake at the side of which the station is situated. The most interesting part of this report is the confirmation of the correctness of layout and determination of the elements of the system by continuous checking of the earth resistance, re-calculation and measurement of step voltages, etc.—"Earth Electrodes; their Theory and Calculation; a Remarkable System in Italy," R. Dalla Verde and P. Pavesi, *Elettrotecnica*, Vol. 40, No. 5, pp. 230–241, 1953, in Italian.

Brush Losses in D.C. Machines

Under heavy overloads and during transient processes after short-circuits, etc., commutation troubles may arise from various causes, such as saturation of the cores of the compoles, damping effect of eddy currents on the commutating flux, the "transformer" e.m.f. induced in the short-circuited bars by the varying main flux, etc. In these cases the reactance e.m.f. in the commutated bars is partly or entirely uncompensated and the brush voltage drop increases.

Experiments have shown that this phenomenon is very marked after sudden short-circuits when the drop may exceed 100 V and energy may be liberated during the current rush at the rate of 200–240 kW. This cannot but set up dangerous commutation arcs between brushes and commutator which have a tendency to be propagated all around the commutator as flashover of the commutator. The author's method provides a correct and fairly exact theoretical explanation of the processes and agrees very well with oscillograms taken of short-circuit currents and e.m.f.s.—"Brush Voltage Drop and Brush Losses in a D.C. Machine with Commutation Troubles," V. V. Fetisov, *Elektrichestvo*, No. 8, pp. 23–31, 1953, in Russian.

Silicone Insulated Transformers

The characteristics of silicone varnishes depend mainly on the hydrocarbon radicals attached to the Si-O chains; of these, methyl and methylphenyl have the most satisfactory effects, particularly where thermal durability is concerned, whereas the mechanical characteristics are rather inferior to those of other types of varnish. On the other hand, the water absorption is lower than that of all other types of varnish and the protection against moisture improves with ageing. Loss angle and dielectric constant are low (tan $\delta \approx 0{\cdot}001$, $\epsilon \approx 2{\cdot}5$-4) and independent of temperature and frequency, if the varnish is sufficiently hardened.

The dielectric strength of silicone varnishes varies a good deal, and where the requirements are high, only the combination of glass silk, mica and silicone varnish will meet them; for certain purposes, particularly grounding work, silicone rubber and pastes are more suitable than silicone varnishes. In general it may be stated that so far the field of application of silicone insulation in transformer construction has been more or less restricted to special types, for example those used in aircraft or in mines, preferably for voltages not exceeding 6 kV, although American engineers have used silicone insulation for special mining transformers up to 50 kV.—"Silicone Insulating Materials in Transformer Construction," G. Ehlers, *E.T.Z.(A)*, Vol. 74, No. 19, pp. 553–558, 1st October, 1953, in German.

Overhead Line Support Foundations

The transmission of compressive forces from tower foundations to the ground is a problem which may now be considered as solved for all cases of practical interest. The less frequent case in which tower foundations have to transmit tensile stresses was investigated in all its aspects and implications in the department of soil mechanics of the Swiss Polytechnic Institute in Zurich. The problem is important for the anchoring of towers put on stub foundations (i.e. individual foundations for each tower leg).

A correct calculation method has to consider the shear resistance of the soil, in addition to the mass forces. Obviously, these data have to be determined by tests for the kind of soil on which the tower is erected and a suitable, simple and convenient testing method of sufficient reliability had to be evolved. Furthermore, the influences of humidity of the ground, depth of the foundations, and of the permanent stressing had to be clarified. The tests were partly made on models in the laboratory, partly on full-size foundations in the open, a great number of types and sizes of foundations and of anchors being so tested.

A special difficulty in the latter tests was to prevent the reaction forces of the hydraulic press producing the test stresses from influencing the test results. This problem was solved by erecting for the press a special foundation of frame type within which the tested foundation was placed. The tests were entirely successful, since they enabled a fairly general method to be worked out of calculating foundations to withstand tensile stresses and also the most suitable types of anchors for such foundations to be determined. Some of the results were confirmed by tests carried out elsewhere under a much more limited research programme.—"Anchoring of Tensile Loads in the Ground, with Special Reference to the Foundations of Overhead Line Supports," A. G. Muller and R. Haefeli, *A.S.E. Bull.*, No. 21, pp. 905–921, 1953, in German.

Readers who require accurate full translations of any of the articles abstracted in this section can be put into touch with the translators who will supply them at current rates.—Editors, *Electrical Review*.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Life of Filament Lamps

A RECENT interest in large tungsten lamps, necessitated by the use of a new film studio illuminant, revives a debatable point about which even lamp manufacturers cannot seem to agree.

It has been stated in several popular text-books and articles in specialist publications, that the life of a filament lamp is greatly shortened by continually switching it on and off, because the resistance of the filament is much lower when it is cold, permitting a relatively heavy current to flow momentarily. Suggestions have been made regarding series resistors or series-parallel switching, with a view to applying a reduced voltage during the initial " warming-up " period. A recent article in a reputable photographic publication gives details for the construction of various series resistors for increasing the life of projector lamps by limiting the current flow until the filament has warmed up. The author's degrees command my respect, but I am not convinced.

The cause of a filament burning out is heat and disregarding ambient temperature, the only source of heat is the electrical energy which is transformed into thermal energy. By Joule's Law $H = I^2 rt$ joules; and under normal circumstances " t " is taken care of by dissipation. Therefore, the heating produced is proportional to the square of the current multiplied by the resistance of the filament.

The filament has a positive temperature coefficient, so that the heating effect is greater when it is first switched on; consequently it rapidly reaches its working temperature and restricts the current flow to its normal value. Surely it is irrelevant whether the filament reaches this temperature in a few milliseconds, or whether the initial heating period is prolonged by, say, a series resistance, unless, of course, there is some metallurgical reason which makes very sudden changes in temperature undesirable.

As the lamps referred to in my first paragraph are used on a d.c. supply, I have disregarded the effect of inductive reactance caused by the coiled filament, but it would be interesting to know whether the nature of the supply makes any appreciable difference to the life of a tungsten filament.

Edgware, Middx. JOHN BLAND.

Heating and Cooling

MENTION has been made in your columns of applications of heat pumps for office buildings, etc. There has also been reported the installation of large fans in London tube railways to cool them down. The clay surrounding the tubes in some places is at 80 deg F. Why not exchange surpluses for deficiencies to mutually benefit all?

Middlesbrough. GEORGE W. LEADER.

Legislation and Metering Costs

IN reply to " Ray Cath's " criticism of my figure for legislation costs I fail to see how any re-casting will produce a sum of 10s per annum.

The total annual charge including the cost of the meter (provided by a 30 year sinking fund) is only 7s 4d, and of this sum only part can be attributed to legislation. I still maintain that the *maximum* amount which can truly be said to be due to this is 1s 7d per annum.

So far as the " old days " are concerned I, too, can recall an instance where metering was dispensed with in a block of new council flats (the rent included the charge for electricity). Unfortunately the authority had to revert to individual metering since the tenants left lights on day and night, causing serious overloading of the power transformer.

" CATHAY."

High Temperature Turbines

METALLURGICAL aspects of steam and gas turbines operated at above 850 deg F were discussed in a paper presented on 15th January by Dr. J. M. Robertson to the North-East Coast Institution of Engineers and Shipbuilders. Important properties of steels and other alloys used were defined as resistance to creep, rupture, fatigue, relaxation, thermal shock and corrosion. These were considered in relation to composition, treatment and properties of stainless and non-stainless ferritic steels, austenitic steels and alloys based on nickel and cobalt. In addition the paper dealt with welding in regard to high-temperature applications.

At high temperatures (as distinct from atmospheric temperature) time as well as stress in relation to deformation and fracture had to be taken into account. After the first application of stress (initial strain), a constant tensile stress would produce deformation or creep at a rate depending on the metal, temperature and stress. Creep was relatively rapid to begin with, but became slower for a certain period, after which it increased until fracture. A common criterion was a maximum extension of 0·1 per cent in 100,000 hours, but resort was had to extrapolation. The first creep resisting material used for turbines, carbon-molybdenum steel, had an ultimate tensile strength of 29 tons per sq in at atmospheric temperature and 20 tons per sq in at 1,000 deg F, but would break under a stress of 3·5 tons per sq in at 1,000 deg F if applied for 100,000 hours.

Because the rate of oxidation increases with temperature, low-alloy steels become unsuitable above 1,020 deg F, but the addition of 12 per cent of chromium provides resistance to oxidation up to 1,350 deg. All heat resisting alloys now in use above 1,020 deg F owe this resistance to protective films, mainly of oxide of chromium. Many residual oils at 1,200 deg F and over produced an ash containing vanadium pentoxide which accelerated corrosion and restricted the scope of gas turbines. Research, especially during the last twelve years, has resulted in the development of alloys for use between 850 and 1,750 deg F, divided broadly into hardenable ferritic steels and austenitic alloys. Steels and alloys used at high temperatures are classified in an appendix.

Fullagar Engines

In 1920, after fourteen years' production of orthodox four-stroke oil engines, the English Electric Co., Ltd., included in its range of prime movers an opposed-piston two-stroke engine which was later to become recognized as one of the most successful and reliable engines of its size for industrial duty. The licence and drawings of this engine, designed by Dr. Fullagar, were acquired by the company, who required an engine of greater power-weight ratio than the comparatively heavy, slow running engines produced up to that period.

Early designs incorporated air-blast fuel injection, pressurized air being obtained from a reciprocal compressor driven from the free end of the crankshaft. Forty-one engines of this type were built in the years up to 1934, when a higher standard of efficiency was attained by the introduction of mechanical fuel injection equipment, thus eliminating the compressor unit, which absorbed about 10 per cent of the engine output.

In 1929 the first of an additional range of Fullagar engines was manufactured at Rugby. It was a six-cylinder unit and had an output of 2,500 b.h.p. at 200 r.p.m. The bore and stroke of this new size of engine were 19in and 22in respectively, and they were identified by the suffix letter "R" as opposed to the letter "Q" which identified the original 14in bore 16in stroke engines.

The first 2,450 b.h.p. engine of the "R" range was supplied to the Bermuda Electric Light, Power and Traction Co., whose power station already housed three Fullagar engines of smaller output. In 1936 this company received the first of a further four engines of similar bore and stroke, each with outputs of 3,275 b.h.p.—a rating which, until recent years, was unsurpassed by any manufacturer of industrial diesels in the British Isles.

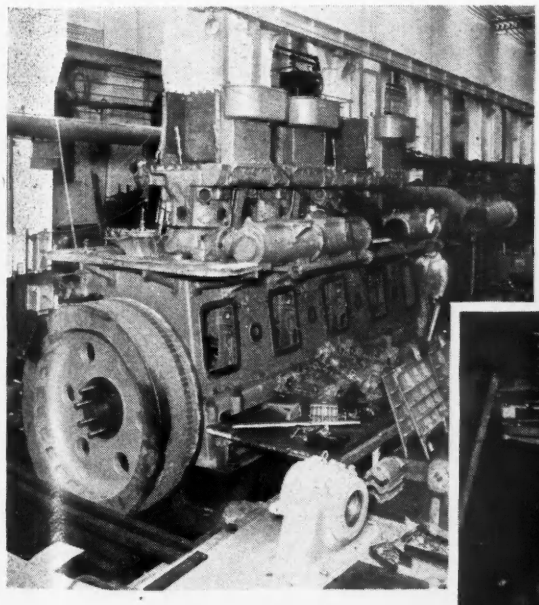
By the 1930's, Fullagar engines had firmly established themselves as ideal prime movers for industrial power generation. Electricity supply companies in many parts of the world had installed engines of varying outputs, either for continuous duty, or as stand-by or peak load plant.

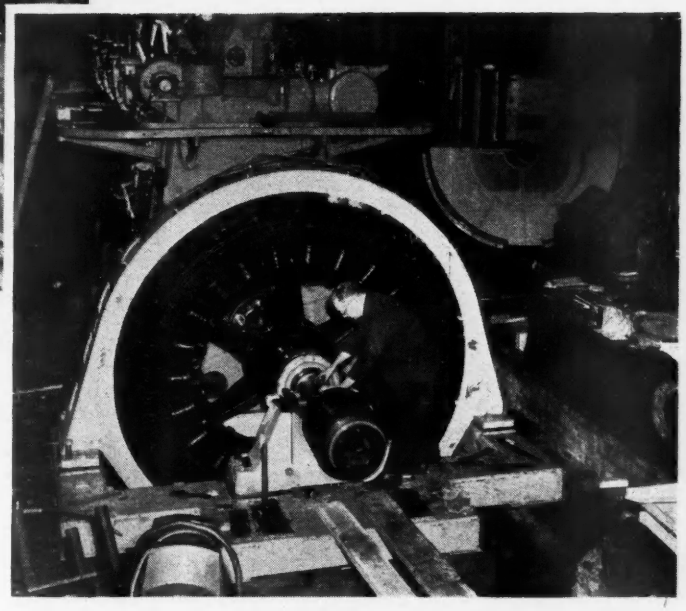
The inherent suitability of the Fullagar engine for continuous load carrying had been fully proved from the start, when a 4Q size engine, rating 750 b.h.p. at 250 r.p.m., was run on steady full load for twenty-one days without a break, completing the exhaustive trials entirely satisfactorily. This engine, the first Fullagar to be manufactured at Rugby, ran for roughly 70,000 hours during its operational life, and is now permanently installed on a site adjacent to the present works power station.

Among the many users of Fullagar engines for power generation is the British Admiralty, whose acquisitions cover several six- and eight-cylinder engines from the "Q" range. The latest order received from them is for four eight-cylinder units for installation in a dockyard power station overseas.

The last engine of this order has now been completed in the company's works at Rugby. Without exception all of the Fullagar engines made at Rugby have been used for electric power production, driving either a.c. or d.c. generators, and the Admiralty sets will be put to similar use. On these contracts the English Electric Co., Ltd., has also supplied the alternators, exciters, switchgear and station accessories.

All engines will be operating eventually on heavy fuel oil, the clarifying and purifying plant for the fuel system being installed by the Admiralty. When in operation, each set will have a site rating of 1,300 kW and will generate at 6,600/6,900 V, three-phase, 50 c/s.





Above: Admiralty 8Q Fullagar engine nearing completion in the Rugby Works of the English Electric Co., Ltd. Right: Aligning the alternator pedestal of the engine before test running

Protection Against Corrosion

Chemical Industry Exhibition

METHODS of protecting iron and steel against corrosion were demonstrated at an exhibition held in the Great Hall, Battersea Polytechnic, on 22nd January. This event was organized by the Corrosion Group of the Society of Chemical Industry, which was formed in 1951 to meet the need for a scientific body in the United Kingdom to deal specifically with the study of corrosion and its prevention. The Group's general aims are to afford a means of communication among chemists, metallurgists, engineers and others concerned with corrosion, to stimulate general interest in the need for the scientific study of corrosion, and to encourage the application in industry of improved methods of prevention.

Silicone paints combine excellent heat resistance with water repellent properties, and this combination makes them particularly effective for the protection of ferrous surfaces operating at high temperature and under humid and corrosive atmospheres. The life of both mild and stainless steel can be considerably prolonged by the application of aluminium-pigmented silicone paints.

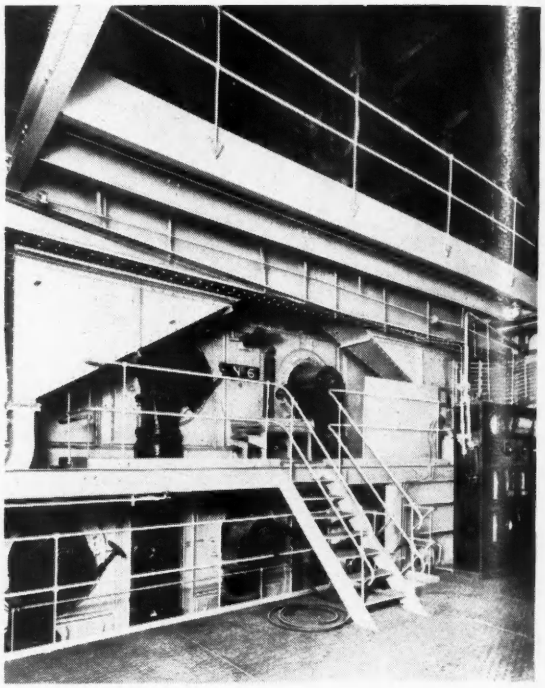
For comparative purposes a number of test specimens were displayed, each of which had been subjected to heat treatment for 30 minutes at 300 deg C. A silicone based enamel was still in excellent condition, whereas enamels based on melamine alkyd and a long oil alkyd showed bad discoloration and loss of gloss.

A silicone-based high-temperature-resisting paint has proved exceedingly useful for the decoration and protection of plant in power stations, and this type of application was exemplified by a photograph of boiler front casings at Hams Hall generating station which had been coated with a silicone-based paint.

The external protection of steel tubes to B.S. 1387 was explained by diagrams and photographs, and it was learned that "security" wrappings for service tubes are applied in the following manner: (1) A primary coating of bituminous composition is applied to the tube; (2) a seamless layer of specially selected bitumen is applied to the exterior of the tube, to a thickness of about $\frac{3}{64}$in; (3) a layer of glass tissue, impregnated with bitumen, is wound spirally on to the tube, with sufficient overlap to act as a seal between adjacent turns; (4) a coating of limewash is applied to the finished wrapping as a final dressing. The layer of bitumen between the wrapping precludes the formation of pin-holes and binds the tube and wrapping together.

This method of treatment was illustrated by a photograph of 72in steel pipes, bitumen lined and sheathed, with short sleeve joints for internal welding, which are in course of installation at Keadby power station to form a circulating water main. These pipes are being laid in sandy gravel, and the special concrete supporting beams rest on concrete piles which extend 50ft into the ground.

Attention was drawn to a vapour phase inhibitor of considerable promise developed at the Chemical Research Laboratory. Known as "cyclohexylamine carbonate," it is prepared by passing carbon dioxide through a suitable solution of cyclohexylamine. This compound possesses marked inhibitive properties in the vapour phase towards steel, cast iron, aluminium, zinc, tinplate, chromium plate, etc., and it is now available as a commercial product and has been proved effective for protecting the inside surfaces of empty fire extinguisher cases in store and for drums which have been emptied of their contents. Laboratory investigations have shown it to be effective for preventing further corrosion of rusted components in "idle" boilers and turbines.



Hams Hall boiler-front casings treated with silicone-based high-temperature-resisting paint (Atlas Preservative Co., Ltd.)

Examples were shown of the established uses of the now well-known vapour phase inhibitor, dicyclohexylammonium nitrite ("Shell" V.P.I.) in corrosion-preventive packing. This inhibitor is particularly useful in highly intricate and delicate mechanisms which cannot be satisfactorily protected by conventional methods. An outstanding advantage is that it need not be in direct contact with the surface to be protected.

Sections of the exhibition were devoted to phosphate coatings, inhibitive primers, electrodeposited coatings, metallization, and other important methods of protection. In many instances the results achieved with different treatments were indicated by displays of test specimens which had been exposed under identical conditions. Methods used in research were also illustrated.

It has been estimated that corrosion is costing the United States $5,500 million a year. Dr. J. C. Hudson has calculated that in the United Kingdom the cost of protecting steel alone amounts annually to somewhere in the region of £200 million. Much of this immense burden is borne directly or indirectly by the electrical industry and its customers. The exhibition was itself an indication of the realistic manner in which the problems presented by corrosion and its prevention are being approached.

Lighting Service Bureau

Summary of Activities for 1953

THE past year's achievements of the Electric Lamp Manufacturers' Association Lighting Service Bureau were surveyed last Friday by Mr. E. B. Sawyer, its manager. More lectures than ever before were given and a greater number of people of every type was reached. Visitors to the Bureau's demonstration rooms in London not only included those from all parts of Great Britain but many from abroad, and the provincial Bureaux and offices also dealt with their share. While the cumulative effect of the Bureau's work was hard to gauge, it was safe to say that its influence on lighting was one of the largest single factors in the progress that was being made.

Probably no other field of lighting had shown a greater overall improvement than that of shops. Every possible opportunity had been taken of obtaining informed opinion on the special lighting requirements of a number of different trades. In this connection, colour-matching fluorescent lamps had proved extremely popular and now were being far more widely employed for general and shop window lighting than E.L.M.A. members visualized when they first introduced them. Used in conjunction with the ubiquitous reflector spotlamps they appeared to offer a solution to almost any display problem.

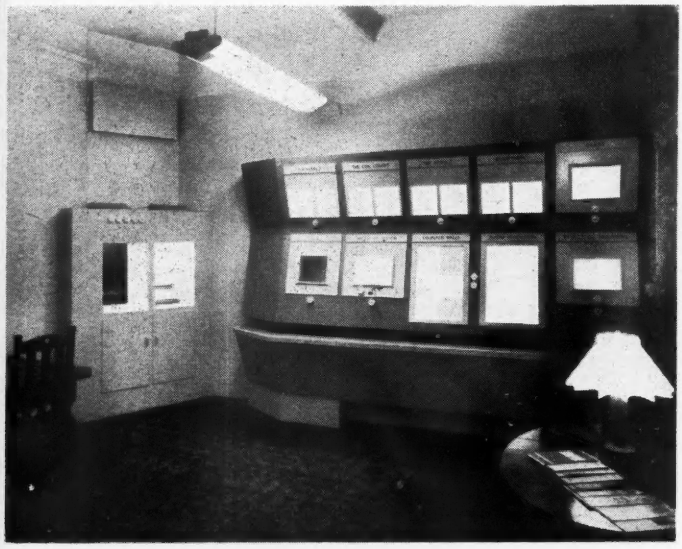
Consultation on industrial lighting problems was more frequently required from the Bureau's area engineers than from the engineers in London. The integration of light and suitably coloured surroundings was no longer regarded as a novelty. There was growing industrial interest in the part group replacement of lamps could play in saving money and man hours in major installations, a direct tribute to the high degree of uniformity achieved through strict quality control. Interest in lighting as an aid to greater productivity was still very much alive.

About 20 per cent of the 453 lectures given by members of the Bureau staff during 1953 were on home lighting and almost every women's organization of note had been in touch with Miss M. D. Wardlaw, the Bureau's specialist on this subject. In her provincial lectures she had made a point of suggesting simple ideas which could be carried out by householders themselves, so that where budgets would not reach to the manufactured article home industry could fill the gaps. There was a growing interest in fluorescent lighting in the home but the major demand had continued to be for filament lamps as, indeed, it was likely to be for many years. It was regrettable that many householders were still very ill-informed about the different types of filament lamps available to them. This position could be considerably remedied if retailers would display a wider range of lamps suitable for domestic purposes.

The Bureau now had premises in Leeds, Glasgow, Birmingham and Newcastle-upon-Tyne, all with demonstration facilities. During the year a part of the Scottish Bureau was reconstructed to make room for a greater number of demonstrations and the Birmingham offices were converted to house Bureau demonstrations, one room for general principles and the other for decorative lighting. It now only remained to find suitable premises in Manchester for the North Western area engineer, for all established areas to be provided with their own demonstration facilities.

The Bureau's press service had continued to provide lighting material for all classes of journal. An example of the way in which Bureau publicity made its mark was provided by the Coronation ideas put out. In the autumn, Mr. T. O. Freeth, the Bureau publicist, visited towns in Holland and Germany, as well as Paris, to study lighting

The Scottish Bureau showing cabinets for comparing the colour-rendering properties of different types of fluorescent lamps



Cabinets showing lighting principles create the chief interest in the main demonstration room of the new Bureau offices in Birmingham

and publicity methods, and much useful information was obtained.

For the first time, in 1953, it became the rule for the Bureau to make a small charge for publications. This had had no noticeable effect on distribution and apart from " Lighting Service," a periodical of the Bureau which has now a circulation of some 24,000 copies, over 30,000 copies of other specialized publications were distributed.

Every year the scope of the Bureau became greater. It had long enjoyed world-wide recognition as the leading source of lighting information in this country and it reached a very large public. By introducing his customer to the Bureau and by using Bureau ideas and publications, the retailer could be certain that he was expanding his market.

Advance information on a number of lighting developments was given by Mr. W. J. Jones, director of E.L.M.A.

Broadcasting in V.H.F. Band

OPENING a discussion by the Institution of Electrical Engineers Radio Section on 25th January as to whether sound broadcasting of the future should be entirely in the very-high-frequency band, Dr. A. J. Biggs expressed the view that by 1970 " alternative programmes " would mean alternative television programmes. Consequently fewer broadcasting stations would be required in the medium and long wave band, making substantially interference-free medium-wave reception possible.

In view of the large number of receivers sold for motor cars and for portable use in the home, manufacturers would find difficulty if all broadcasting were shifted to the v.h.f. band in producing battery driven frequency-modulated lightweight receivers of adequate sensitivity. The v.h.f. equivalent of the simple frame aerial for portable receivers had not been demonstrated. Receivers up to 1·5 Mc/s with their valves and selective tuning devices could be made cheaply. Stability of local oscillators and radiation from them presented few difficulties compared with those for v.h.f. f.m. receivers. Amplitude modulation would still further restrict the possible usage of small portable equipment.

Frequencies in the v.h.f. band (band 2) were ideally suited to many forms of mobile short-range communication systems, and there would be great pressure on the use of such frequencies. The frequency separation permissible between stations would be about 0·4 Mc/s; hence 10 Mc/s would accommodate only 25 channels, which might be adequate owing to reduced interest in sound broadcasting.

The present trend of Government policy on alternative television services might lead to the erection of expensive aerial systems to receive stations of different polarization and different frequencies from different directions. This could lead to acceptance for a built-up area of wire distribution, so that a shift to v.h.f. f.m. might be advantageous, the complication of aerial pick-up being left to one control station. In a distant future, all television services might be in the ultra-high-frequency band, using high-definition colour with accompanying sound on frequency modulation, leaving bands 1, 2 and 3 for a high quality f.m. sound service. Part of the television receiver could then be used with small additions for reception of sound-only programmes.

Transformer Winding Resistances

THE measurement of the resistance of the winding of a 132 kV 60 MVA transformer while in service at Tunbridge power station formed the subject of a paper presented by Dr. K. J. R. Wilkinson and Mr. J. D. Harmer on 2nd February before the Institution of Electrical Engineers (Measurements Section). The method chosen was that in which a small direct current was added to the alternating 50 c/s load current and the direct voltage corresponding to the addition was ascertained. The star winding was chosen as presenting less difficulty than the delta winding. Special means were adopted to overcome the effect upon the d.c. measurement of normal transient variations in system voltage, which enabled the winding temperature to be derived within 3 deg C, compared with 0·5 deg C on short-circuit heat run. These means included a filter stage with electronically enhanced time constant. By measuring in this way the changes in temperature, close agreement was found with the temperature correction rule of B.S. 171 : 1936 for cooling after shut down. Variations in d.c. distribution between the three star windings were given in an appendix. The transformer was cooled by natural oil circulation and had continuously air-blown heat exchangers. Measurements of winding temperature (by resistance) were made after each of a series of six changes from full-load current, the final one being from 140 per cent loading back to full load after running for 43 min on the overload.

Four problems were encountered in the design of the circuit used for measurement and were considered separately by the author. The first was the need to pass a few amperes of direct current into the high voltage windings. The second was the measuring of the d.c. in the presence of an alternating load current which might be as much as 330 A in each winding. The third was the measuring of a continuous potential of about 2 V at the h.v. terminals due to the d.c. passing through the winding resistance; this had to be done in the presence of 7 kV at power frequency and of random system fluctuations—very small when compared with system voltage but appreciable in relation to the 2 V. The last entails comparing the small continuous voltage with the injected d.c., so as to represent the resistance of the winding.

Housecraft Advisers' Conference

Discussions on Food Freezing, Water Heating and Commercial Catering

THE cold weather provided an appropriate atmosphere for the first of the papers read on Wednesday last week at the annual conference of electrical housecraft advisers and senior demonstrators held in London by the British Electrical Development Association and the Electrical Association for Women. With the title "Freezing Food for Preservation," Miss Anne Smith (Frigicold, Ltd.) dealt with the history of the subject, the types of equipment available and the potentialities of the market.

Miss Smith said that in 1953 over 1,000,000 home freezers were sold in the U.S.A., and on 1st January, 1954, there were 5,954,700 in use. There were 43,585,000 homes connected (out of 45,464,000) which meant that 13·7 per cent of consumers used home freezers (90·4 per cent having domestic refrigerators). By 1960 it was estimated that 10 million would be in use. In England we had about 12½ million consumers, and probably some 6,000 home freezers, about 0·0004 per cent. We were only beginning to see the possibilities of frozen food which could do much to ease the housewife's major burden and enable her to make the most of home-grown food, keep down the cost of living, and help the Chancellor of the Exchquer.

Quality of the food treated depended on quick freezing and best results were secured by using only the best foodstuffs, freezing quickly in suitable packets and storing at low temperature. Pre-cooking was necessary to preserve flavour and colour of some foods.

The ice cream conservator was designed for storing ice cream (already frozen) at 20 deg F, and this was not cold enough for freezing food; nor was the insulation adequate. The lids were usually unsuitable, with insufficient insulation and allowing air leaks. Also conservators had no warning device or thermometer. The real freezer cabinet must be capable of freezing quickly, and storing at a low temperature, otherwise there was a loss of nutrient value. As yet there was no great variety of freezer cabinets on the British market. There was a range of farm freezers, properly insulated and freezing at — 20 deg F to — 30 deg F (storing at 0 deg F), with thermometers on the front panels and warning devices (light or bell). There were only two domestic models, the International Harvester, 9 cu ft, and the Prestcold, 4 cu ft, both chest models. The ordinary domestic refrigerator with a cabinet temperature of 35 deg to 40 deg F was quite useless for freezing. The farm freezers were of the chest type (12·25 to 30·5 cu ft), the upright type like a cupboard, and the "built-in" freezer, made by insulating and equipping an existing cellar or pantry. A farm freezer taking 60 lb of food took 6–7 hours to freeze and cost about 2s 6d a week for electricity.

Unfortunately, during the early years, there was much irresponsible salesmanship, by salesmen with insufficient knowledge giving wrong advice, with endless trouble as a result. Incorrect advice could result in unsatisfactory products, or even total loss—and a dissatisfied customer who told all his friends. The salesman must find out the would-be user's requirements, for it was essential that correct and practical advice should be given on the most suitable size of cabinet. The correct use of the freezer must be explained, the importance of not overloading at any one time of freezing being particularly stressed. Packing was important to prevent sticking to the sides of the freezer.

Should the compressor fail to operate for any reason it was imperative that the lid of the cabinet should not be lifted to allow warm air to enter. If the lid remained closed, the contents should remain unspoiled for 12 hours in well-insulated freezer cabinets of 9 cu ft or more. Most cabinets needed to be defrosted only once a year. Besides the saving on food bills, the freezer cabinet had many labour saving aspects, such as storing pastry made, say, once a month, the saving of "left-overs," and the freezing of pre-cooked whole meats. Food which had already been allowed to defrost should never be re-frozen.

Speaking on "Electric Water Heating from the Selling Point of View," Mr. Philip Honey (E.D.A.) said that the matter should not be left to the specialist; it was everyone's job. It was in fact easier to sell electric water heating than electric cooking. In cooking, different temperatures and techniques had to be explained: hot water was just hot water, and no recipes or methods were needed. Technical skill came in later when the specialist decided on details of installation.

The right method of approach depended upon the situation. Consumers either wanted to know, being already interested, or did not know and did not want to know. If an inquiring consumer called, apparatus could be demonstrated and particular requirements discussed. Telephone inquiries, he said, were harder to deal with; in the consumer's home, although there were no appliances at hand, there was an excellent opportunity for obtaining details of the particular circumstances. In every case, however, the basic principles of approach remained: demonstration, discussion of requirements, deduction of quantity of hot water needed and definition of the most suitable type of heater.

Cooking demonstrations offered an excellent opportunity for arousing interest in the uninterested. In the consumer's home, too, some opportunity would present itself; for example, if she were using a kettle for washing-up water. In the showroom, when discussing some other appliance, something in the conversation might provide a lead.

Water Heating Costs

Electric water heaters retained their efficiency indefinitely in practically all conditions, and the amount of electricity required to heat a given quantity of water was constant. About 5 per cent of the heat might be lost in the actual process of heating the water; a further 10 to 15 per cent through the lagging or from the pipes. With good design, good lagging, etc., there should be no more loss. Thus one unit of electricity should give, at the taps, approximately 4 gal of water at 140 deg F. Few consumers knew how much hot water they used but it had been found, by consumer research, that 2 kWh per day per person was a good average figure. One must be careful, however, as to the way this figure was used. No one could say how much hot water any given family would use in a given time. It was far better to give an idea of electricity consumption for typical household requirements such as: a good hot bath, about 4 kWh; say another bathful for dish-washing, hand-washing and sundry domestic chores, about 4 kWh. Water heating was one of the loads Electricity Boards wanted for it would help to maintain or lower prices of electricity.

At the conclusion of his paper Mr. Honey, with the aid of Miss E. Eaves and Mr. J. A. Stedman (both of the E.D.A. staff), demonstrated by two short sketches the wrong and the right approach to the customer. In answer to questions he said that furring up was largely due to the use of unsuitable appliances. The water heater was so well made that it would operate for years without deterioration. According to statistics published by the D.S.I.R. it was cheaper to use electricity for water heating when gas cost more than 1s 4d a therm. Maintenance of gas appliances was considerable.

Wednesday afternoon's proceedings concluded with an outline given by Miss Vera Norvick (E.A.W.) and Mr. Stedman of the prizes and awards open to women in the electrical industry.

At Olympia on Thursday at a visit to the Hotel and Catering Exhibition Messrs. Felix A. Rogers (B.E.A.M.A.) and W. T. Gardiner (Gardiner & Gulland, Ltd.) gave a joint paper on "Commercial Catering: the Part Electricity Can Play." In the first part Mr. Rogers declared that few realized the great potential load there was in commercial catering. It was estimated that the present connected load for commercial electric cooking was between 250,000 kW and 500,000 kW, but with very little effort, and especially if simplified tariffs could be established, there was no reason why this load should not be increased by at least 10 per cent a year, or over 60 per cent in the next five years.

Unlike the Electricity Boards and the manufacturers, the caterer was not interested in sales of electricity or apparatus, but only in securing the best service for his money and he would go for advice to the people who had given him the most help in the past. It was important, therefore, that the Boards' staffs should have established good relations with him beforehand, should be convinced of the excellence of electric cooking, and should understand the problems of different classes of catering. It was important to realize that commercial catering was not "the same as domestic cooking but on a larger scale," and also that there were considerable differences between the various types of commercial catering establishments.

To obtain business in the à la carte establishment one had to have the co-operation of the chef, who was one of the most highly paid members of the staff. The same did not always apply in the table d'hôte establishment where the chef was really a cook and had a correspondingly lower status. Electricity tariffs quoted to the caterer in the holiday resorts might not appeal unless they made sympathetic allowances for special demands for Christmas and Easter. Also in holiday resorts the caterer would consider the replacement of equipment only during the late autumn and early spring. Many an installation demand could be turned to electric by having the equipment available for immediate delivery before the doors were opened at Whitsun for the first guests.

From next April, instead of drawing their equipment for school feeding from a pool provided by the Ministry of Works, each local authority would purchase its own requirements direct and would welcome any help and advice that could be given not only in purchasing equipment but also in its care, use and maintenance. In factories and hospitals it would be foolish to advise the use of electric cooking apparatus where free steam was available. Anything they could do to teach the proper use of equipment in Service camps was all to the good. The use of electric cooking equipment in public buildings and sports clubs was an extremely good form of publicity. Full specialist knowledge was necessary for handling inquiries from fried fish shops.

Entirely new kitchens were erected every day but the replacement of pieces of apparatus provided an opportunity for "getting a foot in the door" and it was on these opportunities that they should concentrate. Intermittent publicity was of little value and it was necessary to have a display centre in each Sub-Area as a continual reminder. The electrical industry had the advantage that in almost every installation electricity was already used for some purpose. Electricity was quicker than gas for steaming and frying, and electric roasting ovens got up to temperature as quickly as, if not quicker than, a gas oven. The boiling plate did not burn thick liquids so readily as gas. The purchase of a small appliance would often lead to the installation of a larger appliance. The temptation should be resisted to sell the caterer a cooker designed for domestic use. It was better to have a part-electric scheme which proved economical

Miss Edna Prophet being presented with the Elizabeth Sloan Chesser Cup by Dame Caroline Haslett. Below: Sir Henry Self delivering his opening address

than an all-electric scheme which would not allow for using waste steam.

If the commercial load was to be developed a much greater effort was necessary and the senior housecraft adviser and the demonstrator should be encouraged to play a greater part. Training of Board personnel for the purpose was of paramount importance, and the younger members of the catering trade should also have the opportunity of training in the use of electric cooking equipment. While capital cost and installation charges were important, the customer was often more concerned with the running cost and trouble-free service. A simplified and reasonable tariff for commercial catering installations would prove the greatest factor of all in encouraging new business. A proper maintenance contract should be arranged with the Electricity Board so that regular inspections were carried out. It was unreasonable to expect manufacturers continually to lend equipment for exhibitions and it was suggested that each Board should purchase a range of equipment for exhibition purposes.

Dealing with recent developments and probable future trends of catering service systems, Mr. Gardiner spoke of the effects of new legislation and also the growing popularity of cafeteria or self-service systems. For food or meals service electric heating had a clear claim to supremacy on account of its freedom from noxious fumes, the comfort of staff and customers due to minimum heat radiation, and the wide range of highly specialized appliances available for which there was no substitute. The stumbling block, however, was that often the premises would need a major re-wiring if the whole of the cafeteria or snack bar service was to be electrically run. Summing up, Mr. Gardiner suggested four slogans: " Start with the service end of an installation and work back to the kitchen," " Keep a close watch on the clean food campaign," " The grill is the backbone of British catering," and " Short orders (called orders) spread the load."

Replying to a criticism of the lack of certain types of apparatus, Mr. Mitchell (G.E.C.) said that there were fashions in catering equipment as in other things and all requirements could be met.

A discussion of the conference and suggestions for the future occupied Friday morning. Mrs. Rawlinson (Scarborough) thought that a reduction in electricity charges would help development but Mrs. Windsor (London Electricity Board) pointed out that the price of electricity in urban areas had only doubled compared with a threefold increase in the price of coal. Miss Norvick, who presided, maintained that the electricity supply industry should be economically self-supporting.

Wishes were expressed for more talks from manufacturers and better demonstration facilities. Miss Norvick said she had been appalled at the conditions in which some demonstrators had to work. Improvements would come, however, but they would be slow. It was impossible to give the most effective demonstrations without a properly equipped service centre.

Record B.E.A. Load

The conference was concluded on Friday with a luncheon over which Dame Caroline Haslett presided. Brief speeches were made by Sir Henry Self, Col. B. H. Leeson and Mr. V. W. Dale.

Sir Henry said that the past week, with its intense cold, had seen the industry's greatest triumph. It had carried a load of 15·7 million kW, although with a certain amount of voltage reduction. This was the highest figure ever recorded. Last year it did not get much above 14 million kW. The electricity supply industry looked upon the housecraft advisers as its missionaries who went out and preached the gospel. Col. Leeson said the value of such conferences was in the contacts and friendships made which played an important part in the industry's development. The housecraft advisers were doing a really worth-while job.

Mr. Dale, in winding-up, referred to the difficulties of development as the result of the war and its aftermath which he estimated had meant a loss of three million cookers. Now that the industry was free again to develop, E.D.A. was planning an immense cooker and water-heating campaign which would be launched in the spring. He urged the housecraft advisers to use all their energies to put electric cooking back on the map.

Relaying Television Programmes

The Manchester–Kirk o' Shotts Link

In a paper presented before the Radio Section of the Institution of Electrical Engineers last night Messrs. G. Dawson, K. G. Hodgson and R. A. Meers (Standard Telephones & Cables) and Messrs. L. L. Hall and J. H. H. Merriman (Post Office) gave a detailed description of the Manchester–Kirk o' Shotts (Scotland) television radio-relay system. This system, which was put into service in March 1952, was, the authors stated, the first permanent broad-band super-frequency undertaking to be operated in Britain, and was designed as a component of a national network.

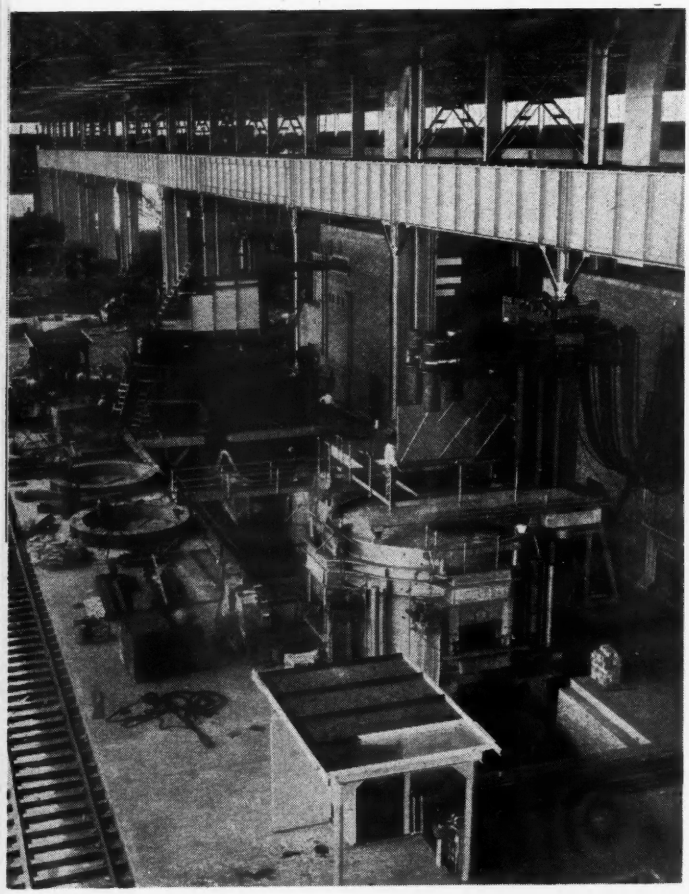
It embodied independent channels of transmission in both directions between defined switching points, each with distribution and injection facilities. A radio link rather than a coaxial cable was adopted as requiring a smaller initial capital outlay and less time in construction. Seven intermediate unattended stations were used with an average link length of 31 miles (maximum 47 miles) in the total route length of 247 miles following a route to the east of the Pennines via Leeds, Newcastle-upon-Tyne and Edinburgh. Very-high-frequency operation was not considered since the bandwidths required could not be readily accommodated.

Full particulars of the equipment were followed by an account of its performance for fifteen months, during which it had met all requirements and proved the stability of its characteristics. It was stated that there need be no significant difference in the methods of maintenance and operation of broad-band radio and cable systems.

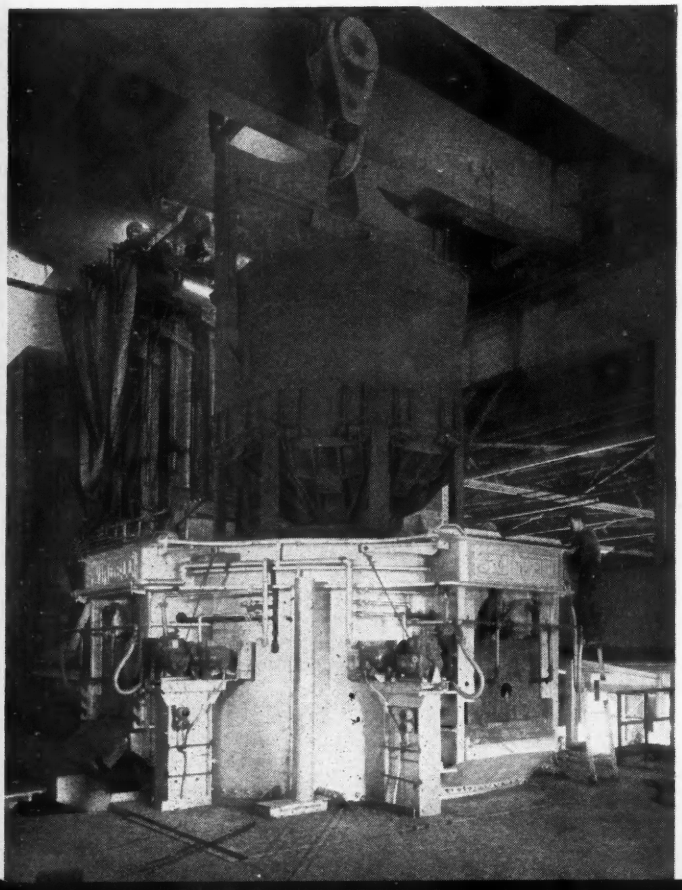
The low incidence of fading (worse in the early hours of the day) was held to have justified the initial circuit planning. Good impedance matching on long feeder runs was an important feature. The existence of external objects in the near field of the aerials might give rise to cross-talk, even though the objects were not in direct line of sight. The travelling-wave amplifier had proved to be a robust and reliable circuit element. Further studies would be necessary regarding the provision of stand-by and supervisory facilities, particularly where transmission over any one route of several radio frequency channels for television or multi-channel work might be required in the future. The relative merits of providing reserve channels or reserve equipment would also have to be considered having regard to local conditions.

ARC FURNACES

Trend of Development in U.S.A.



Large arc furnace installation under construction and (below) large furnace with direct charging basket



IN Sheffield recently Mr. J. C. Howard, director, Electric Furnace Co., Ltd., delivered a lecture to representatives of the electrical and steel industries on his recent visit to Canada and the U.S.A. The visit to Canada was made with the main object of helping to start a new Canadian company by EFCo. in association with the Lindberg Engineering Co., to sell the products of both organizations, while the main purpose of the visit to the U.S.A. was to study the use of large arc furnaces in that country for the production of lower grades of steel. An arc furnace, said Mr. Howard, could make the cleanest steel possible, low in sulphur and phosphorus, and while it was not suggested that we in this country should relax the standards of our high grade steels, the Americans considered that it was bad engineering to make anything better, and therefore more expensive, than it need be. That had led to a wider application of the arc furnace in the U.S.A., in that it was being increasingly used to replace the basic open hearth furnace, melting from cold charges. Rimming steels and semi-killed steels were now frequently made by a single slag process in arc furnaces, and one example of this was an installation of two 22ft diameter furnaces, each with a 25,000 kVA transformer, making plain carbon steels for the production of wire and wire nails and working to two carbon specifications only. The scrap was melted rapidly and superheated, a few finishing additions made and the heat poured. No chemical analysis was made and the quality of the steel was judged by a quick physical test. Each transformer could have its rating increased to 35,000 kVA by putting on a special forced water cooled heat exchanger, but it was very doubtful if the higher rating would be used.

More care was taken with steels for more important duties. For example, steel for transformer irons was in one plant made in 18ft diameter furnaces. The melt was decarburized with oxygen and when both the carbon and sulphur contents were low enough, the heat was "blocked" with a little silicon. The final addition of silicon was made in the ladle. If analysis showed that tramp elements were too high in the first bath sample, the heat was diverted to some other use. It would obviously help to eliminate this trouble with tramp elements if a far higher proportion of pig iron (preferably liquid) to scrap were used. This had been tried in the U.S.A., but the great difficulty was the large slag bulk involved.

A new plant was now being built in which two 24ft diameter furnaces with 25,000 kVA transformers might be used for duplexing, with three 35-ton side blown convertors. This duplexing with Bessemer convertors had been well proved in eastern France. The addition of a large arc furnace to a Bessemer shop, where it would take odd heats from the convertors, would make a good set-up. Doing the preliminary oxidation of the silicon and manganese in convertors meant that the subsequent slag in the arc furnace was much less bulky. A very hopeful proposal on the same lines was to blow liquid iron in a modified ladle with an oxygen lance, following the technique established in arc furnace operation, but just to oxidize the silicon and manganese. The excess slag could then be decanted off

and the hot, high-carbon iron transferred to an arc furnace, where the carbon could be easily removed. Some modifications to the furnace to deal with the extra gas given off might be necessary.

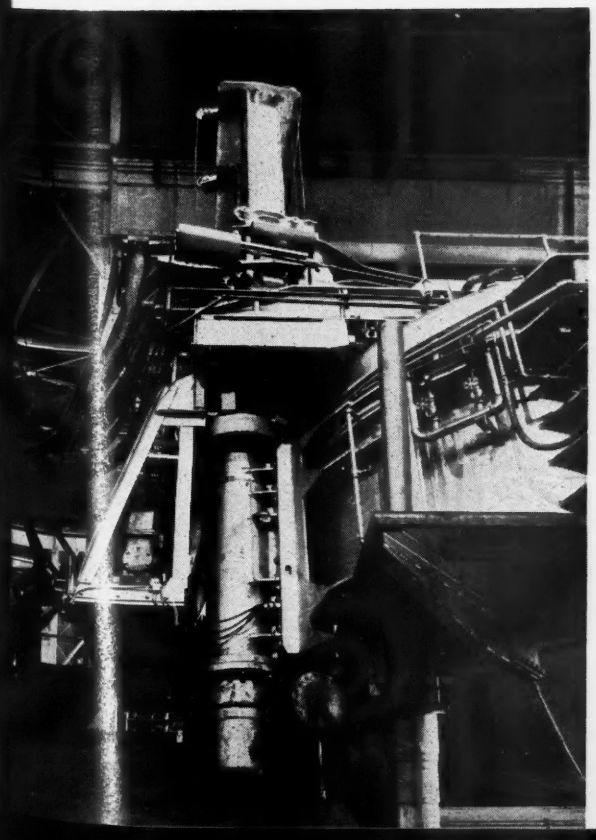
The economics of the making of these cheaper steels in the arc furnaces were dealt with very fully in a report issued recently by the Battelle Memorial Institute, entitled "Comparative Economics of Open Hearth and Electric Furnaces for the Production of Low Carbon Steels."

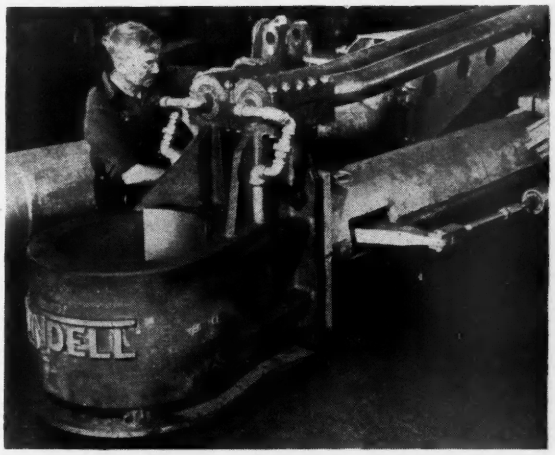
As an example of the American approach to alloy steel making in an arc furnace, an 80-ton heat of 18/8 stainless steel in an 18ft diameter furnace was instructive. The charge of scrap and high-carbon ferro-chrome was selected to melt out at about 14 per cent chromium and 0·6 to 0·8 per cent carbon. The charge was superheated to 1,650 deg C and then blown with oxygen until the carbon was reduced to the required figure, the chromium was about 7 per cent and the temperature was about 1,850 deg C. Slagging off followed by pouring the whole charge into a ladle, decanting the slag and then pouring back the steel into the furnace, having swung aside the roof. Final alloy additions were made in the furnace.

Americans, continued Mr. Howard, swung the roof off large furnaces more frequently than we did, not only for charging lime, ore, ferro-alloys, etc., but even for mixing the bath, when a slab of steel with a great knob of slag on the end of it would be moved through the bath by the crane to give complete mixing. Fumes presented a problem which was sometimes solved in one of two ways. Smaller furnaces of up to 15ft diameter had a sheet steel canopy following the roof brickwork and about 6in from it, and a hood over the door. The fumes were drawn from under this canopy by a large fan. Larger furnaces sometimes had a separate hole in the roof through which the fumes were exhausted via ducting.

Refractory repairs were frequently effected by machines, and one interesting tool was a gun which injected a stream of water, air and a special magnesite powder so that the operator could build up worn sections of the hot wall. Patches as strong as the original material could be obtained.

Water cooled cables and remote control gear at rear of modern arc furnace





Electrode holder on large furnace with deflection plate to divert hot gases from water cooled holder junction

Water bonded magnesite hearths were often used and claims for a life of years were made, but it was not certain that they were, in fact, superior to the graded dolomite hearths used in this country. Side walls were usually of magnesite, but never more than 13in thick, and it might be doubted if our 18in walls were really necessary. Taper nipples for the electrodes were standard and some users preferred a nipple rather smaller than standard. The joints were frequently dowelled after tightening.

In the case of one 20ft diameter furnace with a 20,000 kVA transformer which was inspected an ASEA electric stirrer had been fitted. It was found that sulphurs of 0·005 to 0·007 per cent were common where similar techniques in similar furnaces without electric stirrers gave sulphurs of about 0·02 per cent. This resulted in much less scrap from the rolling mills. Exceptionally low carbons were also far more easily obtainable, while the uniformity of temperature and the homogeneity of the bath were also remarkable.

The Battelle Memorial Institute Report mentioned earlier was sponsored not by furnace manufacturers but by public power suppliers who wished to know what were the future power requirements, so that any bias in the report was not towards furnace builders. The comparative costs given were of course for American conditions, but the relation between open hearth and arc furnace capital costs held for this country. Material costs were quite different, but still in favour of the electric furnace.

Mr. Howard illustrated his lecture profusely with lantern slides which are represented by the selected photographs accompanying this résumé of the lecture.

Electric Trains for Calcutta

ELECTRIFICATION of the railway services on the Burdwan-Howrah main line, under the Indian Railway Board scheme, is expected to be completed in three years from now. One of the main snags was the problem of adequate power supply, but the Damodar Valley Corporation has assured the Board that it will be in a position to supply 40,000 kW of the necessary 50,000 kW from the grid, the rest being made up by the Calcutta Electric Supply Company. Plans are also in hand for electrifying Calcutta suburban services and a survey party is expected to be in the field by the end of April this year.

Gift to College

Presentation of Electronic Equipment Cubicles

AN interesting little ceremony took place on Thursday last week at the electrical engineering laboratories at King's College, Newcastle-on-Tyne, of the University of Durham, when Philips Electrical, Ltd., and A. Reyrolle & Co., Ltd., presented to the College two cubicles of electronic equipment which had earlier been developed by Philips for Reyrolles for experimental work on the development of electronic control of d.c. motors driving newspaper printing presses, the tests for which the equipment was designed having now been completed.

Among those present at the ceremony were Mr. C. I. C. Bosanquet, M.A., Rector of the College, Professor J. C. Prescott, D.Sc., head of the Electrical Engineering Department of the College, Mr. F. J. V. Ritson, B.Sc., lecturer in electrical engineering at the College, Mr. S. G. P. de Lange, general manager, Industrial Products Department, Philips Electrical, Ltd., Mr. C. W. V. Davis, Industrial Products Department, Philips Electrical, Ltd., Mr. L. A. Higson, Newcastle branch manager, Philips Electrical, Ltd., Mr. J. Bennett, director and contracts manager, A. Reyrolle & Co., Ltd., and Mr. A. T. Crawford, B.Sc., assistant contracts manager, A. Reyrolle & Co., Ltd.

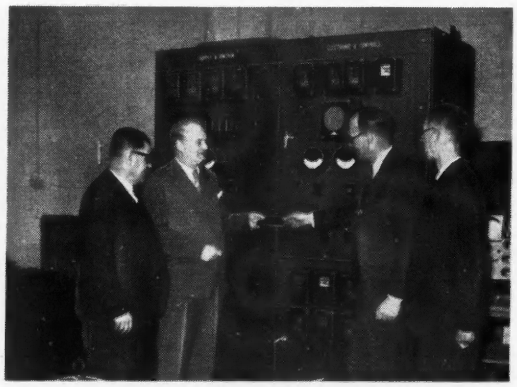
In welcoming the visitors to the College, Mr. Bosanquet stressed the help the College Electrical Department had received from the electrical manufacturers all along, and said that the ceremony which was about to take place was just one example of the practical assistance received. He thought that this was an appropriate time to make a preliminary announcement to the effect that they were thinking about establishing a second chair of electrical engineering at the College, which would have a particular reference to electronics.

Mr. Bennett spoke of the high appreciation Reyrolles had of their close association with the College. He thought that perhaps there was a tendency nowadays for colleges to concentrate rather too much on the light current side of electrical engineering. Industry still wanted the heavy electrical engineering man and he felt that this type of student should have a good background appreciation of electronics.

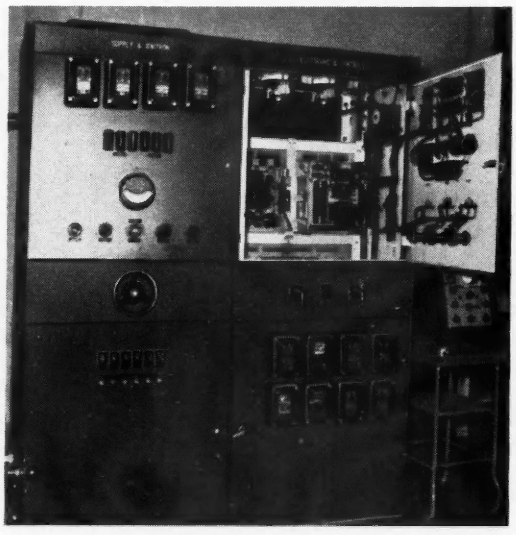
Mr. de Lange said that when he first came to this country he soon learnt of the wonderful work in electrical engineering of Durham University, so that when Reyrolles made the suggestion of handing over the equipment to King's College he was delighted. He could see great possibilities in the further development of electronics, and Philips were pleased to make their contribution in the presentation.

In thanking the donors on behalf of the College, Dr. Prescott said that Reyrolles had always been very kind to them and they always felt they could ask Reyrolles for advice without feeling an obligation to take it. He agreed about the importance of electronics in the heavy electrical engineering field.

The actual ceremony took the form of Mr. de Lange handing to Mr. Bosanquet an inscribed plate which is to be mounted on the presentation equipment. The equipment is an example of the modern form of rectification to be used with d.c. motors and consists of variable-voltage rectifiers to feed the armature of a d.c. shunt motor and separate rectifiers to supply the field current, the output of the rectifiers being controlled electronically. All the necessary equipment for rectification and automatic control is housed in a combined cubicle divided into four sections.



Mr. de Lange handing to Mr. Bosanquet an inscribed plate. Mr. Bennett and Professor Prescott also appear in this photograph. The presentation equipment consisted of two cubicles of electronic equipment which have been used for experimental work in the development of d.c. motors driving printing presses



Mounted on a panel at the back of the left-hand section are six water-cooled ignitrons, with the cooling water flow relays above. The front of this section contains the a.c. main isolating switch and anode fuses, whilst mounted on the doors are certain of the control relays and fault indicators. The rear of the right-hand section contains the ignitron firing and electronic control units, and the thyratron field rectifier. The front doors of this section have the remainder of the control relays mounted thereon, together with a motor-operated rheostat for controlling the output of the ignitrons and field rectifier.

The motor speed is increased from zero to line speed (say half of full speed) by increasing the armature voltage, and is increased from this speed to full speed by reducing the voltage and hence the current applied to the field. Throughout the shunt speed range the power factor and efficiency of the system are high, the power factor being the same at half

speed as it is at full speed. Overcurrent protection is provided by anode fuses, also by a control circuit which provides automatic current limitation which over-rides the speed control circuit. Speeds from crawling to top speed are stabilized against variation in load and voltage by the use of IR drop compensation and a voltage stabilizer for the feed to the electronic control unit. The equipment has a maximum output of 240 kW at 400 V d.c.

World Bank Business

Where British Firms Fall Short

BY A SPECIAL CORRESPONDENT

THAT United Kingdom industry is at last beginning to take a more practical interest in the International Bank for Reconstruction and Development is the first impression one receives on reading the report of the representatives of the Federation of British Industries following their visit to the Bank's headquarters in Washington recently.

The Bank's lending activities over the last seven years have extended to all parts of the world. Even so the mission finds it necessary to stress the need for " more activity by all concerned in the United Kingdom in their relations with borrowing countries." This can only mean one thing: United Kingdom business men must go out and get the business and not wait for it to come to them.

The mission was greatly impressed by the high quality and impartiality of the Bank's staff who were said to be completely international in outlook. Although there is a good proportion of British on the Bank's staff the mission points out with regret that none of them are engineers.

The permanent staff is comparatively small and it does not attempt to maintain the large number of specialists which it finds necessary to utilize from time to time in connection with its activities. A large roster is maintained, which has been accumulated over a period of years, and from this the specialized personnel are selected for missions on an international basis. Obviously the advantages which the United Kingdom gains in having one or more of its nationals on a Bank mission, or forming one of a team engaged in an overseas development project, cannot be measured exactly; but the absence of even one British representative can easily be construed abroad—rightly or wrongly—as an indication of Great Britain's lack of interest in affairs beyond her own border. This impression can gain ground not only in foreign countries but in the Dominions as well.

Staff Recruitment

In making the recommendation that there should be a review of the methods by which candidates from the United Kingdom are put forward, either to fill vacancies on the Bank's regular staff or as members of Bank missions, is not to say that the right men are not available. " Liaison has been inadequate and there has been insufficient appreciation of the calibre of the men required," states the report.

Some time ago attempts were made to recruit staff for the Bank through the Ministry of Labour and National Service but this met with little or no success for the simple reason that men possessing the specialist qualifications required by the Bank are not the sort of people who normally seek employment through a labour exchange. Therefore some new expedient must be tried.

About 40 per cent of the Bank's lending so far has been made for electrical development schemes and if the proportion is going to be maintained at or about the same level in the future an obvious need for electrical engineers will have to be met. Most of these appointments will be of a temporary nature but some practical step needs to be taken by the British electrical industry to make these people available.

This will need some planning by the industry as a whole. A panel of " electrical experts " representing all branches of the industry and nominated by their respective companies could perhaps be established, so that when a call for an individual with certain qualifications was notified by the Bank a suitable name could be submitted. In this way the employer of the person chosen would second him for a particular World Bank assignment—and re-instate him at the conclusion of his tour of duty.

No doubt some quite convincing arguments could be advanced by individual companies against the inclusion in such a list of any of their top-flight technical executives, but national prestige is at stake and some means will have to be found of overcoming any narrow prejudices.

Funds Freely Convertible

So far as " getting the business " is concerned, members of the F.B.I. mission admit that they are not satisfied with some aspects of our commercial intelligence. No doubt this will be rectified in due course. Admittedly, in the United Kingdom at any rate, the World Bank has not had a particularly good press—so much so in fact that even now many people tend to regard it as a branch office of the Export-Import Bank of Washington, a purely American concern. That loans are always announced, and expressed, in terms of dollars, no doubt adds to this impression. Actually the Bank's " units of accounts " are kept in dollars, but although up to now U.S. dollars have formed the bulk of lendable funds they are freely convertible and may be spent by borrowers in any member country, provided that country has duly paid up its Bank subscription. (An article on the World Bank appeared in the *Electrical Review* of 10th October, 1952.)

The Bank encourages competitive bidding on an international scale, but, apart from satisfying itself that the successful tenderer is competent, does not influence the placing of the contract. Therefore British firms stand as good chances of getting business as their competitors—that is, in theory. Where British firms fail, according to responsible opinion within the Bank itself, is that with one or two exceptions, no concerted effort appears to have been made *by Great Britain*—note the emphasis—to secure any given contract.

Most of the projects financed by the Bank are in the sphere of public works and public utilities, such as hydro and other power schemes, irrigation, ports, railways, etc., and generally one designated authority in the borrowing

country is responsible for a project's execution. Not surprisingly, therefore, the authority concerned prefers to deal with one main contractor—and that is where the British system of individual tendering falls short.

A proportion of any major power scheme involves a large amount of civil engineering work, but how many organized groups of consulting engineers, contractors and manufacturers—working as a single entity—are to be found in the United Kingdom? They can be counted on the fingers of one hand. This factor in tendering for projects sponsored by the World Bank must be recognized by the industry and plans made to establish effective organizations to meet this requirement.

Generally speaking, electrical manufacturers are aware of this failing, but, as in very few instances are they called upon to act as main contractors on a major project, their scope at the moment is somewhat limited—but a great deal can be done by making the idea, and the need, more widely known.

Although members of the F.B.I. mission express some doubt as to whether good projects for Bank sponsorship will come forward fast enough, any doubts they may have are qualified by the view that since many schemes reaching the Bank are ill-prepared there is room for increased activity by consultants, etc., to overcome a possible future shortage.

The members of the mission included Mr. R. R. Costain, Mr. E. Griffith, Sir Norman Kipping and Sir Bruce White; their report, published under the title " The World Bank," is obtainable from the Federation of British Industries, price 2s 6d.

FRIENDLY CRITICISM

PARTICULARS of a report by a United States productivity team on the British Electricity System, with comments (under the above title) on its chief features, were given in the *Electrical Review* of 1st and 8th May last. The provisional conclusions then reached have been confirmed and amplified with a weight of supporting evidence in a 33-page pamphlet which the British Electricity Authority has, somewhat belatedly, published in association with the Area Electricity Boards and the National Advisory Council of the Electricity Supply Industry.

The preponderant note of the pamphlet is, briefly, that many practices found suitable in one country may be found inexpedient in another whether in place or in time as measured by the stage of development among other considerations. The differences, which have been discussed from time to time in this journal, are many. They relate to such matters as: climate; historic and legal background of electrical progress; procedure for satisfying views as to amenities; distribution of population; transport conditions; availability of suitable power station sites (and its effect on transmission arrangements and individual output of generating sets) in regard to ample water supplies, fuel delivery and proximity to coal fields and load centres; burning of lower grades of coal in this country, often containing such impurities as chlorine which at present militate against the use of very high steam temperatures; and lower daily load factors. There is also the aftermath of the war in the need to make up leeway by the provision of new plant as quickly as circumstances permit in the face of competing claims of export, national shortages of materials and restrictions on the allocation of capital.

The B.E.A. comments indicate that there can be no doubt of the ability of British manufacturers to meet all requirements as and when overall economic considerations make their application feasible. Criticism of the United States report does not, in our view, depreciate its value as a source of information about foreign practice, particularly that based on operating experience. An interesting feature is the indication it gives of trends there, since some of the suggestions it contains refer to what is proposed rather than to what has already been done and may well be adopted here when the time is ripe.

DOW PRIZE COMPETITION

IN memory of John Stewart Dow and in virtue of a bequest by him, the Illuminating Engineering Society offers a prize which will be awarded to the winners of a competition intended to encourage collaboration between students of illuminating engineering or those branches of engineering concerned with illumination, and students in other fields in which applied lighting plays an important part. While entries from individuals are not excluded, the competition is primarily intended for students working in collaboration. The winning entry will receive a total cash award of £75 and a certificate will be presented to each member of the winning team. Certificates of commendation will be awarded to any other entries of outstanding merit. The subject for the 1954 competition is the layout, lighting, decoration and furnishing of a dining room and cocktail bar in a city hotel. Relevant documents with instructions as to the form which entries should take will be available on 1st April; forms of application may now be obtained from the secretary of the Society, 32, Victoria Street, London, S.W.1. The competition is open to anyone who, not having completed his 26th year by the opening date (1st April), can show that he is taking or has taken a course of instruction, or has had equivalent training of a nature appropriate to the subject of the competition. All members of a team must comply with these conditions. The last date for submission of entries is 15th November next. The competition will be set and judged by a panel of assessors appointed by the Society, in co-operation with the Royal Institute of British Architects and the Institution of Electrical Engineers.

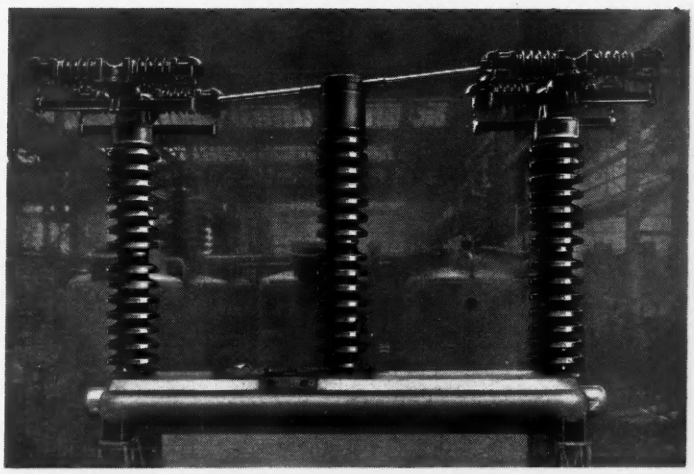
TECHNICAL EDUCATION

AT the January monthly meeting of the Ipswich and District Electrical Association held at Electric House, the president, Mr. C. T. Melling, gave an address on " The Technological Age." He traced the development of technical science as applied to the electrical and engineering industries.

There was, he said, now a great need for more technicians of all grades to enter the electrical industry, to enable the country to hold and further develop the export market. It was disturbing to note, according to the report on education issued by the Institution of Electrical Engineers, that there was a decline in the number of suitable people leaving the universities to become science and mathematics teachers in technical colleges and schools. He thought the time had arrived for the education system to be adjusted so that more young persons were encouraged to enter the industry for training as technicians and craftsmen. Mr. Melling thought that perhaps the industry itself could take a lead by suggesting visits of masters and pupils of schools to engineering establishments to see industry at work, and also by sending representatives to schools to give details and explain modern developments.

Electrical Manufacturing—1953

Metropolitan-Vickers Electrical Co., Ltd.



One-phase of a 275 kV air-blast circuit breaker type GA10W8

DURING 1953 some thirty Metropolitan-Vickers steam turbo-generator sets with a total capacity of 785 MW were put into commission. More than half of the plant (570 MW) was for the British Electricity Authority, a greater capacity than in any previous year. The plant installed at new stations included the first 60 MW sets for Carrington and Chadderton, the first two of 52·5 MW for Carmarthen Bay, the first two of 30 MW for Roosecote and one of the same rating for Bold.

In the export field, 22 sets were put into operation, ranging in output from 3 MW to 50 MW. Orders have also come in for many new sets for use at home and abroad; these include a number of hydrogen-cooled generators, one of which is designed to operate at a hydrogen pressure of 15 lb/sq in. The 15 MW gas turbo-generating set installed in the Trafford power station of the B.E.A. has built up a considerable amount of running experience during the year. The experimental gas turbine plant at the company's Trafford Park works has been run experimentally on various batches of heavy oil fuel, in addition to carrying factory peak loads.

Waterwheel generators completed include the last of four 17·1 MVA vertical shaft machines for Victoria and the second of two 3·5 MVA units for Colmenar in Spain, these being driven by Francis turbines at 600 r.p.m. and also the second of two 8,333 kVA 167 r.p.m. Kaplan-driven machines for Torr Achilty in Scotland.

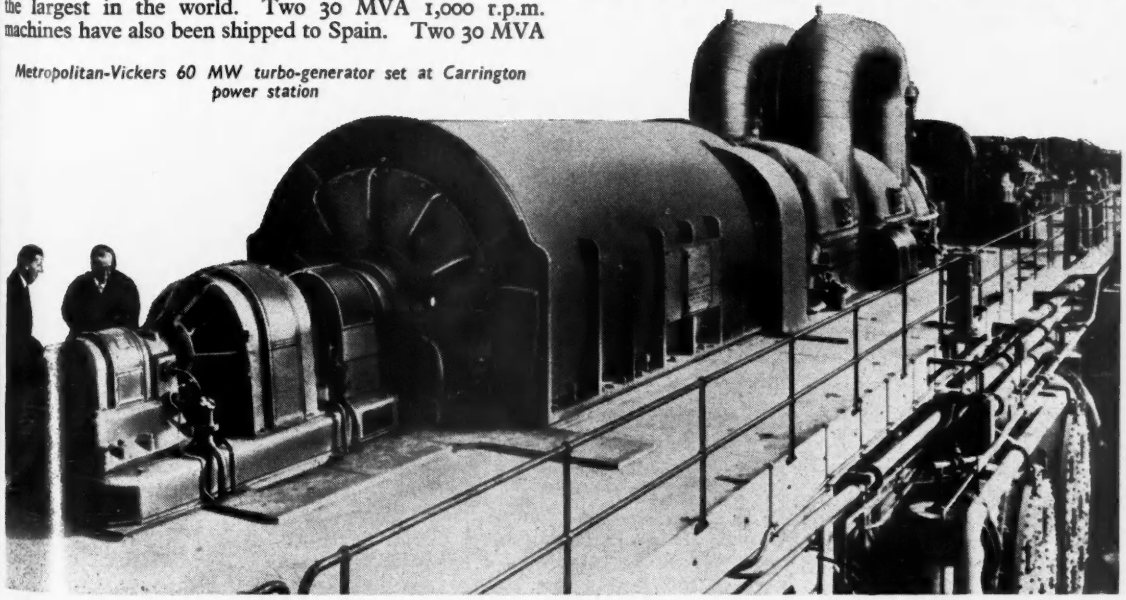
The 40 MVA 1,000 r.p.m. synchronous generator dispatched to the Malvern substation in Victoria is the largest ever built in Great Britain and for its speed one of the largest in the world. Two 30 MVA 1,000 r.p.m. machines have also been shipped to Spain. Two 30 MVA generators are in hand for New Zealand, two similar ones for Spain, two 20 MVA machines for South Africa and two of the same rating for Northern Rhodesia.

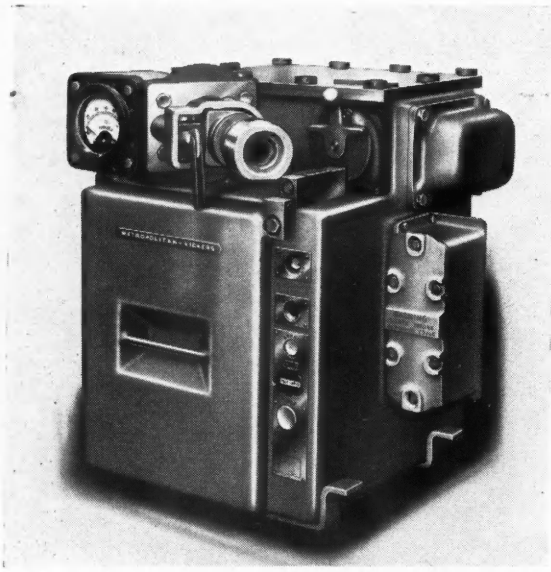
The year's output of large power transformers for the home market has gone principally to the B.E.A. Units delivered include the second 132 kV voltage regulator for a 90 MVA network, on-load tap changing gear being fitted to compensate for a quadrature voltage variation of ± 15 per cent in 24 steps; two further 132 kV groups of single-phase non-magnetically-shielded reactors; and three 60 MVA and one 45 MVA transmission transformers.

During the year, many mercury arc rectifiers have been ordered, particularly for "unified boiler control" equipment: for instance, the seventh set of 550 kW and 75 kW units for Pretoria and five more 365 kW sets for East Yelland (B.E.A.). Rectifiers have also been supplied for colliery locomotive haulage and for gas cleaning plant.

In the switchgear field over 70 air-blast circuit breakers in the 220/300 kV range are now in service or on order.

Metropolitan-Vickers 60 MW turbo-generator set at Carrington power station





The MCU82 mining contactor unit is fitted with intrinsically safe l.v. pilot control and earth leakage electrical lock-out circuits

The GA10W8 air-blast breaker has been further developed for the Staythorpe transforming station of the B.E.A. on the 275 kV grid and similar breakers are in hand for the switching station at Carrington. This breaker has undergone short circuit tests, a life test, a heat run, and a series of impulse and 50 c/s overvoltage tests, and it has also been tested under actual system conditions at the testing station of Electricité de France near Paris.

Indicating instruments for switchboard and industrial use are in steady demand. Ammeters and voltmeters of the DR permanent-magnet moving-coil type recently developed are now in full production at the Motherwell works. Many orders have been received for complete protective schemes of the more complex high speed types. These include 40 equipments for high speed impedance protection, using type DZ relays.

The wide range of Metro-Vick products for industrial and commercial application supplied during the year included motors and control gear for electric drives, electric welding, heating, lighting and testing equipment, and compressors and vacuum pumps. Some very large motors were dispatched during the year, principally for rolling mills and winding engines, and others have been ordered for collieries, steelworks and oil companies.

Large contracts have been secured for single-phase f.h.p. motors for washing machines, particularly for service in New Zealand and Norway. The company's standard lines of motors, certain control gear and accessories have been officially accepted by the Canadian Standards Association. Control gear of special types has been developed for various purposes particularly in the mining industry. New series and shunt limit switches now in production are, among other improvements, fitted with one compound lever that provides for all types of operation.

Equipment for electric arc welding in an inert gas such as argon has been designed with a view to ensuring economy in the use of gas, tungsten electrodes and electricity and also to extending the use of existing plants to inert gas arc welding. Standard a.c. sets have been produced, and a surge injector unit (an E.R.A. development) enables standard transformer sets to be used for inert gas welding.

In the induction heating field the most interesting of the larger furnace plants put into commission is a 550 kW, 1,500 c/s equipment for the melting of alloy steels used in the centrifugal casing of the cylinder liners of i.c. engines. Each of the two hydraulically tilted induction furnaces, steel bodied and magnetically shielded, is designed to melt 17·5 cwt of steel an hour; the control employs voltage stabilization by means of series capacitors and automatic power factor correction.

On the industrial side the company has been concerned in the extension of a large cement plant in Northern Rhodesia requiring 45 motors, including four 500 h.p. mill motors, a 120 h.p. variable speed kiln motor, and two 170 h.p. motors for a coal mill and induced draught fan; the total h.p. is about 3,500 and the contract also covers transformers, h.v. and l.v. switchgear, cables and lighting. An order has also been received for a further extension to a large plant in Greece while many main and auxiliary drives have been commissioned for rolling mills and others are being erected or are on order.

Some 31 electric winder equipments were completed in 1953, their combined output being 49,000 h.p. Nine equipments totalling 29,000 h.p. operate on the Ward-Leonard system of control, several being automatic winders fitted with bi-directional control using a biasing unit and long range cam gear. A further 22 equipments were supplied with the M-V transductor scheme of dynamic braking. The largest haulage equipment supplied was one of 400 h.p.; a 300 h.p. equipment was fitted with dynamic braking. In addition, 22 transductor dynamic braking equipments were supplied for existing winders and haulages.

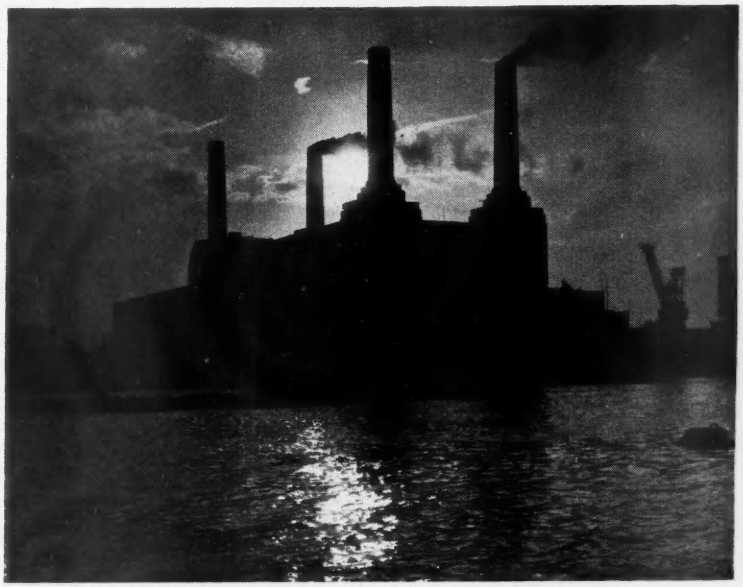
A new 80 A mining contactor unit or gate-end box, type MCU82, complies with N.C.B. Specification P3/1950 and has several improvements in design. The earth leakage protection and remote control circuits on this unit and also on the mining drill units, types MU12 (high frequency) and MDU32 (50 c/s), conform with the safety requirements of the Ministry of Fuel and Power. Other schemes involved include those in the oil and petroleum industry, in power stations, the textile industry, water supply and drainage, and the complete drive and control of two rubber calendering machines in a tyre factory which has been put into commission. The last plant is for continuous processing of rubberized fabric at any speed up to 60 yd/min and is the only one of its kind in the country.

The first of the 1,100 77½ ton diesel-electric locomotives for the Western Australian Government railways was shipped last month. Forty-eight are in hand, the mechanical parts being made and the locomotives erected by Metropolitan-Vickers—Beyer, Peacock, Ltd., at Stockton-on-Tees. The first electric trolley locomotives in a British coalmine have been put into service by the N.C.B. at Sandhole Colliery where they are now hauling tubs and man-riding vehicles. The company supplied not only the locomotives but also the mercury arc rectifier substation equipment and switchgear, the colour-light signalling and power operated points equipment.

Metrovick general service lamps are now fitted with fuses in the caps to overcome any tendency towards arcing when the filament reaches the end of its useful life. A notable improvement in the range of fluorescent lighting fittings is the all-plastic turret type lampholder, which is now fitted as standard to 5ft 80 W fittings; this lampholder, which embodies its own end-shields, improves the look of the fittings and makes lamp replacement easier.

In science and medicine the company has supplied atomic research equipment, microscopes and diffraction apparatus, mass spectrometers, particle accelerators and various other items of specialized equipment.

GENERATION AND DEVELOPMENT



For many years Battersea power station has been familiar as the exemplar of "electrical" architecture. The building has recently been completed and this silhouette shows it to be still a worthy representative of its class

Battersea Power Station

TO THE casual observer the Battersea power station of the British Electricity Authority, London Division, is now complete, with its fourth chimney at the south-east corner of the building. Actually only the shell is finished and the linings of the gas washing plant will not be ready until later this year. The generating plant capacity of the station is now about 500 MW, this figure being made up of two 68 MW sets and one 105 MW set in station "A" and two 100 MW sets and one 60 MW set in station "B." The present boiler capacity is 4,475,000 lb/hr, made up of six 250,000, three 300,000, two 400,000 and three 425,000 lb/hr boilers. Beyond this point three more boilers of 425,000 lb/hr each are expected to be installed by 1956. The total quantity of fuel consumed in 1953 was 722,151 tons, which included 754 tons of oil. The thermal efficiency of Battersea "B" for 1952 was 28·7 per cent, which excluded the plant used for the Pimlico district heating scheme.

Overhead Line Risks

Referring to a recent fatal accident as a result of overhead lines coming down, Billingham-on-Tees U.D.C. asked the North Eastern Electricity Board to lay certain of the cables for supplying electricity to houses underground. In reply, the Electricity Board said that while it would be rash to give a completely unqualified assurance that no accidents could happen, the lines in question were constructed in accordance with regulations and fitted with highly efficient protective gear to reduce risk to an absolute minimum. To lay the lines underground would cost £9,555 or about £12 to £13 per house. The Council is still in touch with the Board on the subject.

Commercial Tariffs Criticized

Members of Leeds Chamber of Commerce have unanimously approved a report, submitted by the president, Mr. Geoffrey A. N. Hirst, M.P. for Shipley, in which the Yorkshire Electricity Board's new commercial tariffs are criticized. The report is the result of evidence collected by the Chambers of Commerce and Trade and the Yorkshire Brewers' Association and gives eleven examples of inconsistent charges, and also contains a reply received from the Board following an interview between representatives of the three associations and the chairman of the Y.E.B. The Leeds Chamber decided to send the report to associated Chambers in Yorkshire, the local M.P.s, and the Minister of Fuel and Power. The members were also reminded by Mr. Hirst that it was likely that the Y.E.B. would introduce a similar tariff for industrial users in the near future.

Continuity of Supply in Mines

The Council of the Durham Area of the National Union of Mineworkers has decided to press for an emergency power system at collieries where electricity is used for winding engines and other apparatus. At a meeting of the Council it was stated that in the event of a power failure, ventilation of the pits would be interfered with through the stopping of the fans and unless there was some alternative means of winding cages and operating other electrical apparatus, danger could arise to miners underground.

South Wales Rural Programme

The South Wales Electricity Board last week presented to the Consultative Council at Cardiff a plan for the further electrification of rural areas. After a careful review of the situation, the Board's view was that the rural areas of South Wales could be fully developed in 15 years and the plans before the Consultative Council covered about one-third of the task. Development at the increased rate contemplated called for the fullest co-operation from farmers and landowners throughout the Area, not only in the matter of granting the necessary facilities for the erection of overhead lines, but also in the utilization of the new service to the fullest extent possible. The Board pointed out that a large proportion of the farmers already connected utilized the supply to a very meagre extent. Indeed, 40 per cent used less than £10 worth of electricity each year and, having in mind the heavy cost of rural development, the Board pleaded for the full co-operation of consumers in electrifying those services around the farm where increased productivity and economy to the farmer would result. If this were done, the financial results of the development would be substantially improved.

Installation Plans

Penrith U.D.C. is to ascertain the number of tenants in Council houses, at present served only with gas, who want electricity installed. The Electricity Board has announced that it may be possible to commence work laying the necessary mains sooner than expected.

Blaydon-on-Tyne U.D.C. is to install electricity in another 25 houses at Bleach Green which are at present served only by gas.

Perth Corporation proposes to seek sanction to borrow £1,790 for the renewal of the electrical installation at the Canal Street wash-house.

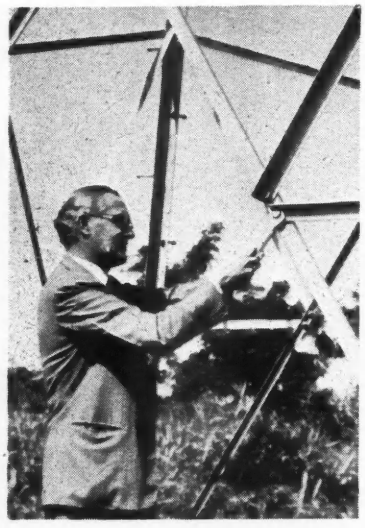
Farm Electrification in Ulster

Lord Glentoran, Minister of Commerce, said in the Northern Ireland House of Commons last week that in the five years 1949 to 1953 the following numbers of farms were connected to the Electricity Board's system of supply: 611, 845, 1,483, 1,328 and 1,431. In addition, the following other rural dwellings were connected: 4,684, 3,654, 4,163, 3,826, 3,543. The Electricity Board expected that during this year from 1,000 to 1,200 farms

would be connected and from 3,500 to 4,000 other rural dwellings. The rate of acceptance of the terms now being offered by the Board was gratifying and augured well for the future.

First Tower Completed in Uganda

The first 132 kV overhead transmission line in East Africa is now being constructed for the Uganda Electricity



Mr. C. R. Westlake, chairman of the Uganda Electricity Board, tightening a nut on the first 132 kV line tower

Board by British Insulated Callender's Construction Co., Ltd., through its contracts office in Uganda. Work is already well advanced, and at an informal ceremony recently, Mr. C. R. Westlake, chairman of the Board, tightened the last nut on the first erected tower to be completed. This line of approximately 120 route miles is in two sections and runs westwards from Owen Falls to Kampala, and eastwards from Owen Falls to Tororo. The lines will transmit power from the Owen Falls hydro-electric station which the Queen will officially open on 29th April during her visit to East Africa.

Tax on Water Heaters

The North Western Electricity Consultative Council is to urge abolition of purchase tax on water-heating appliances, supporting a similar move made by the Merseyside and North Wales Consultative Council. Alderman Frank Kenyon, chairman of the Council, said on 29th January that the tax on storage water heaters prevented a hot water service being installed in thousands of old houses. The Government was encouraging the modernization of old houses and one of the most important aspects of modernization was surely a hot water supply.

Bulk Supply Charges

Changes in the B.E.A.'s bulk supply tariff will, it is estimated, cost the North Western Electricity Board more than £350,000 next year, Mr. A. O. Johnson, the Board's chief commercial officer, told a meeting of the area Electricity Consultative Council in Manchester on 29th January. The Board would do everything possible to avoid raising electricity charges to consumers but it would have to review the situation in the light of all other factors.

In the case of the South Eastern Area, the revised bulk supply charges operate slightly in favour of the Board. This was stated at last week's meeting of the Consultative Council held at Croydon. The chairman (Commander D. S. E. Thompson) said that the concession applied in two ways: the abolition of the charge for the Sunday load and the altered basic running charge. The Board, which had a large week-end cooking load, had raised the matter of the m.d. charge with the Central Authority. At the moment, however, the concession was only for one year. Later in the meeting when the cooking load was discussed the secretary (Mr. G. Wray) said that if the Board could get a guarantee from the Central Authority that the freedom from the Sunday load charge would extend over a period of, say, five years, it could go fully ahead with the development of this load.

Fens Sub-Area Development

Colonel A. E. Knights, manager of the Fens Sub-Area of the Eastern Electricity Board, announced last week plans for " streamlining " the organization. The Huntingdon and St. Ives branches have been amalgamated and branch boundaries are under consideration. Col. Knights said that the problem of reducing the amount and value of the stores in the Sub-Area to a working limit was being tackled vigorously. Since the decision was made to centralize it, stock has been reduced by £172,000 during the past twelve months. Good progress was being made in the extension of the 132 kV supply from Little Barford to Fulbourn. He gave details of a scheme of rural development, and said that one major scheme would begin in April, 1955, and was estimated to cost £45,000. It would supply ten villages sixty-five farms and 295 other dwellings

B.E.A. Contracts

Contracts have been placed by the British Electricity Authority during the past month for power stations, transforming stations, and transmission lines, amounting in the aggregate to £6,263,794. The principal contracts include the following:—

Brighton " B " power station: Shoreham harbour development works.—Peter Lind & Co., Ltd. Shoreham harbour lock gates.—Head Wrightson & Co., Ltd.

Tilbury power station: Foundation for second half of station.—Holloway Bros. (London), Ltd.

Castle Donington power station: Foundations and aqueducts. — Taylor Woodrow Construction, Ltd. Structural steelwork.—Sir Wm. Arrol & Co., Ltd. 415 V contactor control gear and associated equipment.—Contactor Switchgear, Ltd.

Willington " A " power station: One 120 MVA generator transformer.—English Electric Co., Ltd.

Nottingham power station : Coal handling plant.—International Combustion.

Hams Hall power station: Railway sidings.—Wm. Jones, Ltd.

Bold " A " power station: High pressure pipework and valves.—Aiton & Co., Ltd.

Connah's Quay power station: Superstructure.—J. Gerrard & Sons, Ltd.

Ince power station: Auxiliary switchgear.—English Electric Co., Ltd.

York power station: Two 100,000 lb/hr boilers.—Richardsons Westgarth (Hartlepool), Ltd.

Carrington power station: Circulating water pipework.—T. B. Pearson & Sons.

Huncoat power station: One 305,000 lb/hr boiler and structural steelwork.—Simon-Carves, Ltd.

Fenchurch Street Station Lighting

A new cold-cathode lighting installation has been completed at Fenchurch Street Station. This is the first application of its kind to passenger station lighting and the fittings have been specially designed by Ionlite, Ltd., in conjunction with I.C.I., to the requirements of British Railways. The new fittings are shown in the accompanying picture.

Cold-cathode lighting at Fenchurch Street Station

NEXT WEEK'S EVENTS

Organizers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 231, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Monday, 8th February

BIRMINGHAM.—Imperial Hotel, 6 p.m. I.E.E. South Midland Supply and Utilization Group. "The Royal Festival Hall: Electrical Installation," by J. G. Hunter.

BRADFORD.—Technical College, 7.15 p.m. Bradford Engineering Society. "Railway Electrification," by A. S. Robertson.

CARDIFF.—At the South Wales Institute of Engineers, Park Place, 6 p.m. I.E.E. Western Centre. "The Technical Arrangements for the Sound and Television Broadcasts of the Coronation Ceremonies on 2nd June, 1953," by W. S. Procter, M. J. L. Pulling and F. Williams.

DUNDEE.—Mathers Hotel, 7.30 p.m. Incorporated Plant Engineers, Dundee Branch. Film evening.

LEICESTER.—Electricity Offices, Charles Street, 7 p.m. Leicester Electrical Society. "Photo-Electric Cells in Industry," by G. A. G. Ive.

LONDON.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers. Informal meeting. Discussion on "Will it be Possible to Abolish Meters Entirely?" opened by H. S. Petch and M. Whitehead.

St. Ermin's Hotel, 7 p.m. A.S.E.E. Central London Branch. "Electrical Equipment of Aircraft," by R. D. Jones.

MANCHESTER.—Engineers' Club, Albert Square, 7.30 p.m. Junior Institution of Engineers, North Western Section. "The Design and Construction of Special Electro-Mechanical Devices," by F. E. Bancroft.

Grand Hotel, 6.45 p.m. Institution of Works Managers, Manchester Branch. "Productivity and Materials Handling," by L. Landon Goodman. (With film.)

NEWCASTLE-UPON-TYNE.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North-Eastern Centre. "The First Stage of the Electrification of the Estrada de Ferro Santos a Jundiai (late Sao Paulo Railway)," by R. J. B. Chatterton and D. H. Rooney.

NORWICH.—Stuart Hall, 7.30 p.m. I.E.E. district meeting. "Modern Developments in Domestic and Industrial Heat Pumps," by J. A. Sumner. (Joint meeting with the Norwich Engineering Society.)

SHEFFIELD.—The University, Western Bank, 6.30 p.m. I.E.S. Sheffield Centre. "Lighting in the Design of Schools," by A. Pott.

Tuesday, 9th February

BELFAST.—Presbyterian Hostel, Howard Street, 6.15 p.m. I.E.E. Northern Ireland Centre. "The Testing and Specification of Bushings in Relation to Service Conditions," by H. Barker and H. Davies.

BIRMINGHAM.—Grand Hotel, 7 p.m. Institution of Works Managers, Birmingham Branch. "Anglo-American Council's Report," by G. Way.

EDINBURGH.—Heriot-Watt College, 7 p.m. I.E.E. South-East Scotland Sub-Centre. "Fluorescent Discharge-Tube Circuits and Operating Problems," by J. Cates.

ELTHAM.—Congregational Church Hall, Court Road, 8 p.m. A.S.E.E. South East London Branch. Films.

KENTON.—Rest Hotel, Kenton Lane, 8.15 p.m. A.S.E.E. North West London Branch. "Motor Control Gear," by R. F. Mathieson.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Centre. "Special Effects for Television Studio Productions," by A. M. Spooner and T. Worswick.

LIVERPOOL.—Adelphi Hotel, 6.30 p.m. Institution of Works Managers, Merseyside Branch. "Financing of Industry," by K. G. Lyon.

LONDON.—At the Institution of Electrical Engineers, Savoy Place, 5 p.m. Institution of Post Office Electrical Engineers, London Centre. "Step-by-Step Auto-Exchange Maintenance in the U.S.A." by E. Hopkinson and J. Prescott.

2, Savoy Hill, 6 p.m. Illuminating Engineering Society. "Flameproof Lighting," by D. A. Strachan.

Connaught Rooms, Great Queen Street, W.C.2. 12.30 for 1 p.m. Electrical Industries Club. Luncheon.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Supply Group. "Service Experience of the Effect of Corrosion on Steel-Cored Aluminium Overhead-Line Conductors," by Dr. J. S. Forrest and J. M. Ward.

NEWPORT.—Tredegar Arms Hotel, 7 p.m. Newport and District Electric Club. "Planned Inspection as Applied to Electrical Gear," by S. R. Phelps.

RUGBY.—College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Sub-Centre Students' Section. "The Development of 50 c/s Traction in France," by E. J. Davies.

Tuesday, 9th February, to Thursday, 11th February

CHELTENHAM.—Town Hall. National Power Farming Conference.

LONDON.—New Horticultural Hall. Amusement Trades Exhibition.

Wednesday, 10th February

ABERDEEN.—Caledonian Hotel, 7.30 p.m. I.E.E. North Scotland Sub-Centre. "Fluorescent Discharge-Tube Circuits and Operating Problems," by J. Cates.

BATH.—Electricity Showrooms. I.E.E. Bristol Students' Section. Short papers evening.

BIRMINGHAM.—95, New Street, 7 p.m. A.S.E.E. Birmingham Branch. "Power Factor Correction," by H. R. Herning.

BRADFORD.—Midland Hotel, 7.30 p.m. A.S.E.E. Bradford Branch. "Electronics," by E. Craven.

COVENTRY.—At the G.E.C. Works, 7 p.m. I.E.E. South Midland Students' Section. "Some Applications of Electronics to Telecommunications," by Col. C. E. Calveley.

HACKBRIDGE.—I.E.E. London Students' Section. Visit to Philips Electrical, Ltd., at 2.30 p.m.

HALIFAX.—19/23, Northgate, 7.30 p.m. I.E.S. Huddersfield Group. "Lighting for Enjoyment," by T. O. Freeth.

HOVE.—S.E.E.B. Headquarters, 6.30 p.m. I.E.E. Southern Centre. "Some Design Features of the Semi-Outdoor Power Station at Ince," by F. H. S. Brown.

LONDON.—Savoy Place, 5.30. I.E.E. Radio Section. "Basic Ground-Wave Propagation Characteristics in the 50-800 Mc/s Band," by Dr. J. A. Saxton. "Ground-Wave Field Strength Surveys at 100 and 600 Mc/s," by Dr. J. A. Saxton and B. N. Harden.

At the Royal Institution, Albemarle Street, 7 p.m. Television Society. Fleming Memorial Lecture on "Colour Television," by G. G. Gouriet.

NEWCASTLE-UPON-TYNE.—Neville Hall, Westgate Road, 6 p.m. British Institution of Radio Engineers, North-Eastern Section. "Some Aspects of Micro-Wave Aerial Design," by J. Bilbrough.

PRESTON.—N.W.E.B., Friargate, 7.15 p.m. I.E.E. North Lancashire Sub-Centre. "Service Experience of the Effect of Corrosion on Steel-Cored Aluminium Overhead-Line Conductors," by Dr. J. S. Forrest and J. M. Ward.

YORK.—City Hotel, Lendal, 7.30 p.m. A.S.E.E. York Branch. "Joints for Power Cables," by B. A. Maxted.

Thursday, 11th February

CHELMSFORD.—Public Library, 7 p.m. I.E.E. London Students' Section. District meeting. "Industrial Consumer Installation Practice," by J. J. Peacock.

DUNDEE.—Royal Hotel, 7 p.m. I.E.E. North Scotland Sub-Centre. "Fluorescent Discharge-Tube Circuits and Operating Problems," by J. Cates.

LIVERPOOL.—Electricity Showroom, Whitechapel, 7 p.m. E.P.E.A. Merseyside Technical Group. "Safety Precautions in the Electric Supply Industry," by L. A. Corney.

LONDON.—Savoy Place, 5.30 p.m. Institution of Electrical Engineers. Extra meeting. "A Short Review of Modern Fundamental Electromagnetic Theory," by P. Hammond.

2, Savoy Hill, 6.30 p.m. Institute of Welding, South London Branch. Discussion on "Training and Testing of Arc Welders," opened by A. E. Swetnam, B. E. Lambie and A. B. Tompkins.

MANCHESTER.—N.W.E.B., Town Hall Extension, 6 p.m. I.E.S. Manchester Centre. "Lighting for Enjoyment," by T. O. Freeth.

SWANSEA.—Central Public Library, Alexandra Road, 6 p.m. I.E.E. West Wales (Swansea) Sub-Centre. Discussion on "Automatic Control," opened by Prof. D. N. Cass-Beggs.

Friday, 12th February

BIRMINGHAM.—Midland Hotel. Incorporated Plant Engineers, Birmingham Branch. Annual dinner.

T.I. Social Club, Oldbury. E.I.B.A. Birmingham Branch. Dance.

BRADFORD.—45–53, Sunbridge Road, 7.30 p.m. I.E.S. Bradford Group. "Lighting for Enjoyment," by T. O. Freeth.

LEEDS.—The University, 6.30 p.m. Institute of Fuel, Yorkshire Section. "Aspects of a National Fuel Policy," by G. Nabarro.

LONDON.—Savoy Place, 6.30 p.m. I.E.E. London Students' Section. Conversazione and dance.

Holborn Restaurant, W.C.2. Institute of Welding. Joint dinner of London Branches.

Connaught Rooms, Great Queen Street. Institution of Works Managers, London Branch. Dinner and dance.

Townsend House, Greycoat Place, 7 p.m. Junior Institution of Engineers. "Steam Utilization and Heat Conservation," by L. Clegg.

NEWCASTLE-UPON-TYNE.—At the Mining Institute, 6.15 p.m. North East Coast Institution of Engineers and Shipbuilders. "First Stage Reconstruction of Portobello Power Station, Edinburgh," by T. P. Everett.

STONE.—Crown Hotel, 7 for 7.30 p.m. I.E.E. North Staffordshire Sub-Centre. Annual dinner.

Saturday, 13th February

LONDON.—I.E.E. London Students' Section. Visit to Royal Festival Hall at 10 a.m.

MANCHESTER.—Café Royal. Institution of Works Managers, Manchester Branch. Annual dinner-dance.

Financial Section

STOCKS and SHARES

THE state of Stock Exchange markets can again be described as firm, with a disposition to react promptly, and positively, to encouragement. Evidence of the latter comes in the shape of a spectacular jump in the price of Cable & Wireless stock on the company's declaration of a small, but unexpected, dividend increase. Market activity centres mainly on company positions which promise something of the same kind during the coming season of dividends and reports for 1953. As can be seen from the accompanying price lists, industrial share prices have in many instances reached levels which give a distinctly exiguous appearance to yields based on last year's dividends. Persistently good demand for many of these issues suggests, none the less, that results to come are receiving the major part of the investor's interest.

Cable and Wireless Dividend

A jump of 19 points, to 167, in the price of Cable & Wireless (Holding) ordinary stock gives the measure of the market's satisfaction with the company's dividend and bonus declaration, and the preliminary profits statement. A moderate increase in the group profit has been rather more than offset by larger interest charges this time, but although the net surplus of £317,000 is a few thousands below last year's figure, the rate of the ordinary dividend is being raised 1 per cent to 9 per cent (costing £248,000 net). The fact of its being declared as a single payment, whereas last year's 8 per cent included 2 per cent as bonus, is read to imply the Board's confidence in the firmness of the new rate. An additional proposal to issue from reserves a 10 per cent stock bonus provides further evidence of the success with which the trust's fortunes have advanced, under Sir Edward Wilshaw's direction, since its reconstruction in 1950.

Upward Movements

C. A. Parsons followed up the previous week's rise of half-a-crown with another of 1s 3d, Reyrolles following suit this time. A.E.I., Lancashire Dynamo and Automatic Telephone advanced to the same extent. Telegraph Construction and S. Smith continued to move upwards, and other shares in favour include B.I.C.C., British Thermostat, English Electric, Thornycroft, and Laurence, Scott. Allen Wests were marked up to 13s 6d; it is thought that the placing of a large block of the shares, recently overhanging the market, has been completed. Marryat & Scott, officially unchanged at 5s 3d, have changed hands up to 1s higher than that. British Electric Tractions were yet another 1s to the good at 41s 6d, and minor improvements occurred plentifully elsewhere down the list of electrical shares.

Hoover Prospect

Hoover, Ltd., are usually among the first in the field with their annual

Week's Price Changes

Company or Board	Nom. Value	Middle price 1st Feb.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1953 Highest	1953 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	90½	+½	3	3	3 6 3	90	83 11/16
Brit. Elec. 1974/77	100	89		3	3	3 7 5	89	82
Brit. Elec. 1976/79	100	95	+1	3⅛	3⅛	3 13 8	94⅜	88⅛
Brit. Elec. 1974/79	100	105		4⅛	4⅛	4 1 0	104	99⅛
Overseas Electric Supply								
Calcutta Elec.	£1	19/-		6†	6†	6 6 4†	21/-	18/-
East African Power	£1	21/6		7	7	6 10 3	25/-	20/9
Nigerian Elec.	£1	24/6		10	10	8 3 4	25/-	21/6
Palestine Elec. "A"	£1	17/6		Nil	Nil	Nil	19/3	7/7
Perak Hydro-Elec.	£1	15/3	+3d	Nil	6	7 17 3	17/10	13/6
Equipment and Manufacturing								
Aberdare Cables	5/-	8/6		20	25	7 7 0*	8/9	7/4
Aerialite	1/-	11/9		88⅛	88⅛	7 10 3	11/6	8/1
Allen, W .H.	£1	50/-		15	15	6 0 0	51/-	42/10
Aron Elec. Ord.	£1	43/9		15	20	9 2 9	47/6	36/3
Assoc. Elec. Ord.	£1	45/6	+1/3	20	20	4 8 0*	45/7	36/4
Automatic Tel & El.	£1	66/3	+1/3	15	15	4 10 6	65/3	55/-
Babcock & Wilcox	£1	47/9	−6d	18	18	—	50/-	40/4
Baldwin, H. J.	2/-	5/3		20	20	7 12 6	4/1	3/-
Bakelite	10/-	25/6		—	12½	4 18 0	24/9	16/-
British Aluminium	£1	36/6		12	12	6 11 6	43/10	35/-
B.I. Callender's	£1	40/-	+9d	9	10	5 0 0	40/10	33/3
B.I. Callender's 6% Pref. ...	£1	25/6		6	6	4 14 10	26/3	23/-
British Thermostat	5/-	18/9	+1/3	30	35	—	19/-	14/-
British Vac. Cleaner	5/-	13/9		25	25	9 1 9	16/6	11/-
Brook Motors	10/-	31/6		20	20*	6 7 0	37/-	27/10
Brush Ord.	5/-	4/3		10	4	—	5/4	2/11
A. F. Bulgin	1/-	3/3		30	30	9 4 6	3/5	2/6
Burco	5/-	12/9		35	35	6 17 3*	12/2	8/6
Chloride El. Storage	£1	47/6		15	20	4 4 3*	44/10	32/3
Clarke Chapman	£1	72/6	−1/3	15	17½	4 16 6	70/6	57/6
Cole, E. K.	5/-	24/-	+9d	25	25*	5 4 3	23/9	14/2
Cossor, A. C.	5/-	8/-	+6d	10	10	6 5 0	11/4	6/4
Crabtree	10/-	27/-		17½	17½	6 9 8	32/6	23/9
Crompton Parkinson Ord. ...	5/-	14/9	+3d	11½	20	6 15 6	16/-	8/7
De La Rue	5/-	13/-		35	Nil	Nil	14/6	6/3
Decca	5/-	38/6	+1/-	112½	150	3 18 0*	37/9	17/6
Desoutter	5/-	16/9		16	18	5 7 6	17/6	14/3
Dewhurst	2/-	6/-		19	19	6 6 8	6/9	5/-
Dictograph Tel.	2/-	5/4½		20	20*	7 9 0	5/10	3/10
Dubilier Condenser	1/-	4/4½	+1½d	28	25*	5 14 3	4/4	2/10
E.M.I.	10/-	12/9		12	8	6 5 6	15/3	11/6
Electrical Components	5/-	12/-		20	20	8 6 8	12/-	9/3
Elec. Construction	£1	53/9		15	15	5 11 9	56/-	50/6
Enfield Cable Ord.	£1	20/6		7½	5	4 17 6	24/10	17/-
English Electric	£1	41/3	+6d	15	15	—	40/8	34/-
English Electric 3¾% Pref. ...	£1	16/-		3¾	3¾	4 13 9	16/4	14/6
Ericsson Tel.	5/-	48/9		22†	22†*	2 5 2†	48/9	36/
Ever Ready	5/-	26/6		35	35	6 12 1	29/-	25/-
Falk Stadelmann	£1	38/3		15	15	7 16 10	44/3	38/3
G.E.C. Ord.	£1	40/-		22½	11¼*	5 12 6	46/-	36/3
G.E.C. 6¼% Pref.	£1	27/-		6¼	6¼	4 16 3	27/7	24/9
General Cables	5/-	16/9		30	30	8 19 2	17/-	14/9
Greenwood & Batley	£1	42/-		15	17½	8 6 9	41/6	38/-
Hackbridge Cable	5/-	11/9		20	20	8 10 3	13/-	10/4
Hackbridge & Hewittic	5/-	17/-		20	20	5 17 8	18/3	16/1
Hall Tel. Acc.	10/-	11/6		10	10	8 14 0	12/7	8/6
Heatrae	2/-	4/-		12½	12½	6 5 0	4/3	3/3
Henley's	10/-	16/6	+3d	20	10½*	6 7 4	19/4	16/-
Holophane	5/-	13/9		20	20	7 5 6	13/9	11/1

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

results, and if last year's precedent is followed, the final dividend and preliminary results for 1953 will be known before this month is out. A year ago the figures reflected the effects of a contraction of business both at home and abroad, ascribed to high purchase tax and credit restrictions in this country, and the imposition of import cuts overseas, notably in Australia. A reduction in the company's ordinary dividend from 35 to 25 per cent resulted, and the price of the 5s shares was down at one time to little more than 20s. The quotation has since picked up steadily, until to-day's figure of 26s 9d is near the best recorded for about two years past. On the basis of the last rate of dividend, the yield works out at a trifle more than 4½ per cent, from which it may be inferred that expectations look for good results this month and, perhaps, a restoration of the previous cut in the dividend.

in Electrical Investments

Company or Board	Nom. Value	Middle price 1st Feb.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1953 Highest	1953 Lowest
Equipment and Manufacturing—continued.								
Hoover	5/-	26/9		35	25	4 13 6	26/10	20/3
I.C.I.	£1	54/9		13	13	4 15 0	54/-	41/6
Intl. Combustion	5/-	14/9		25	15*	5 1 9	15/6	12/1
Johnson & Phillips	£1	50/6		15	15	5 18 3	59/3	49/-
Lancashire Dynamo	£1	45/-	+1/3	12½	12½	5 11 0	47/-	41/-
Laurence, Scott	5/-	14/3	+6d	15	15	5 5 3	14/6	11/9
Lister, R. A.	£1	32/-		9	9	5 12 6	34/3	27/9
London Elec. Wire	£1	40/-		12½	15	3 15 0*	38/3	26/-
J. Lucas	£1	53/6	+1/6	9⅛	10⅝	4 1 6	51/3	35/6
Marryat & Scott	2/-	5/3		22½	22½	8 11 6	6/3	5/1
Mather & Platt	£1	54/-	+6d	12½	15	5 11 0	53/10	41/3
Metal Industries	£1	40/-		15	12*	6 0 0	47/9	37/9
Midland Elec. Mfg.	£1	63/9		15	15	4 14 0	63/9	56/3
Morphy Richards	4/-	19/-		40	40	8 8 6	16/3	13/-
Murex	£1	53/-	+6d	15	15	5 13 2	60/9	50/6
Newman Ind.	2/-	2/4½	−1½d	10	10	8 8 6	2/10	2/-
Oldham & Son	1/-	2/9		35	17½*	6 7 3	2/10	2/2
Parnall (Yate)	5/-	5/-		6	6	6 0 0	4/9	2/6
Parsons, C. A.	£1	42/-	+1/3	10*	12½	—	48/-	27/9
Plessey	5/-	40/6	+1/6	25	30	3 14 3	37/-	20/1
Pye Deferred	5/-	18/6	+1/-	18	20	—	16/3	10/6
Revo	10/-	17/3		27½	27½	—	17/6	13/11
Reyrolle	£1	68/9	+1/3	10*	12½	—	79/-	51/-
Rheostatic	4/-	11/3	+3d	16½	19	6 15 0	12/-	8/-
Richardsons Westgarth	5/-	9/3		12	15	8 2 3	11/1	8/6
Scottish Cable	4/-	13/6	+3d	32	20*	5 18 6	13/3	11/1
Siemens Ord.	£1	36/-		10	10	5 11 0	37/-	31/6
S. Smith (England)	4/-	13/-	+3d	12½	15	4 12 4	12/6	7/11
Southern Areas	£1	18/-	−6d	5	6	6 13 4	19/7	10/3
Strand Elec.	5/-	8/9		17½	17½	10 0 0	10/-	7/9
Sturtevant	5/-	32/6	+6d	17½†	18·1†*	—	29/9	20/10
Sun Elec.	£1	25/-		15	15	12 0 0	27/-	24/6
Switchgear & Cowans	5/-	12/6		22½	22½	9 0 0	16/9	12/6
Taylor, T.	5/-	12/3		20	25	5 2 0*	12/3	9/6
T.C.C.	10/-	42/6		20	20*	—	42/6	31/5
T.C. & M.	£1	33/-	+6d	10	8½*	5 3 0	31/6	25/6
Telephone Mfg.	5/-	7/6		10	10	6 13 3	9/4	7/1
Thorn Elec.	5/-	16/-		12½	12½	3 18 3	14/-	7/10
Thornycroft	£1	36/9	+1/-	15	15	8 3 3	54/-	29/9
Tube Investments	£1	65/-	+1/3	15*	15	4 12 3	71/9	54/-
Vactric	5/-	10/-		Nil	Nil	Nil	10/3	3/6
Veritys	5/-	5/3	+3d	7½	10	9 10 6	5/4	4/1
Wallsall Conduits	4/-	46/3		70	70*	6 4 6	47/6	43/9
Ward & Goldstone	5/-	43/9		45	45*	5 2 9	46/-	29/9
Watford	2/-	4/10½	+1½d	25	25	—	5/6	4/10
Westinghouse Brake	£1	66/3	+2/6	14	15	4 10 6	64/-	51/3
West, Allen	5/-	13/6	+9d	15	15	5 11 0	14/4	10/3
Wolf Electric	5/-	13/-		—	15	5 15 6	12/8	9/6
Trusts, Transport and Communications								
Anglo-Am. Tel.:								
A Ord.	100	83½		—	6	7 3 9	91	77
Ord.	100	53½		—	3¾	7 2 10	57½	53
Anglo-Portuguese	£1	22/9	+6d	8	8	7 0 8	23/9	20/1
Brit. Elec. Traction:								
Def. Ord.	5/-	41/6	+1/-	25	35	4 4 3	39/6	21/3
Cable & Wireless:								
Ord.	100	167	+19	8	9	5 7 9	148	124
4% Loan	100	97½		4	4	4 2 1	97¾	93
Calcutta Trams	£1	19/-		6†	2½†	—	23/6	16/-
Cape Elec. Trams	£1	13/-		5½	5½	8 9 3	13/-	9/-
Marconi Marine	£1	23/9		10	10	6 19 2	31/6	26/9
Oriental Tel. Ord.	£1	78/9	+3/9	16	16	—	75/-	59/-
Telephone Props.	£1	4¾		8	8	—	126/3	33/-
Telephone Rentals	5/-	9/6		10	10*	—	10/-	6/8

Six Per Cent Yields

The recent availability in the market of a fairly large line of W. T. Henley's Telegraph Works 10s shares at around 16s 6d draws attention to the comparatively good yield of £6 7s 4d per cent on the basis of last year's rate of dividend. The latter was equivalent to a total of 10½ per cent on the present ordinary capital, as increased by the share-for-share capital bonus issued a little over a year ago. Difficult trading conditions in some branches of the business during 1952 left the dividend covered less substantially than had been the case for a number of previous years, earnings for that period being equal to about 15 per cent gross. Telephone Manufacturing 5s shares have also been available in round numbers lately, and similarly show a yield of a fraction under 6½ per cent at the offered price of 7s 9d. In this case, a 10 per cent dividend was paid last time from earnings equal to 13½ per cent on the ordinary capital. Both these companies will be due to issue their results for 1953 in three to four weeks' time.

Radio Shares

Attention is drawn persistently to the active state of business in that corner of the electrical market devoted to the shares of the radio manufacturers and allied companies. Cossors have come to the fore lately in rising to over 8s. Murphy moved up to over 9s and Pye deferred gained another 1s to 18s 6d, while the shares of British Wireless Relay, in which those companies are jointly interested, remained steady at a little over 17s. Deccas were firm in advance of the final dividend declaration; Ultra Electrics were good at about 13s; and Plessey at 40s 6d are almost double the price at which they could have been bought at one time last year. The spectacular rise in Radio Rentals continued up to 50s and over.

Westinghouse and Taxation

Taxation for the year ended last September cost the Westinghouse Brake & Signal Co. 60 per cent of the trading profit. On this subject, the chairman of the company said at last week's meeting that the board could make very good use of a substantial part of the £763,000 which went to the revenue authorities. Pointing out that the sum represented more than half the new capital raised by the issue of ordinary

shares a year ago, he emphasized industry's difficulty in paying out taxes on this scale and, at the same time, financing the expansion of production to the extent which would otherwise be possible. Meanwhile the £1 shares, following an advance of 2s 6d last week, stand around their best price (66s 3d) for several years, and the yield of 4½ per cent, based on the 16 per cent dividend, marks their position among the top-grade investments in the industrial market. A factor in their assessment is the figure of over £100,000 charged in the latest accounts for the excess profits levy.

Miscellaneous Matters

Tokyo Electric 6 per cent bonds were marked up to 151, in company with the rest of the list of Japanese issues, following the conclusion of the trade agreement with that country. Up to date, Japan's shortage of sterling has been a main reason for anxiety about the continued servicing of the overseas debt. After being firm last month, the gilt-edged market has further strengthened on satisfaction with the terms of the Government's latest conversion operation. British Electricity stocks show moderate improvements as a result. Telephone Properties have been comparatively quiet at around £4¾ in anticipation of an expected offer to shareholders, but a revival of speculative interest in Oriental Telephones put the price up 3s 9d to 78s 9d. Brazilian Tractions recovered to $14 after a reassuring statement from the company concerning the local position and the dividend prospect.

REPORTS and DIVIDENDS

Cable & Wireless (Holding), Ltd., in a preliminary statement reports a group profit for the year ended 31st December last of £942,000, as compared with £916,805 for 1952, from which is deducted loans interest of £359,000, and United Kingdom taxation of £266,000, leaving a net balance of £317,000 (against £319,605). It is proposed to pay a final dividend of 6 per cent, making 9 per cent for the year. This compares with a final dividend of 3 per cent and a bonus of 2 per cent making 8 per cent for 1952. The directors also propose, subject to the consent of the Capital Issues Committee, to make a free bonus issue of £1 stock for each £10 stock held. This will increase the ordinary stock of the company by £500,000 to £5,500,000.

The India Rubber, Gutta Percha & Telegraph Works Co., Ltd., shows a group profit for 1953 of £216,572, as compared with £357,019 for the preceding year, and after providing £110,771 for taxation, there is a net balance of £105,801 (against £140,665), to which is added £26,465 over-provided tax. General reserve receives £50,000 and a similar amount is placed to contingencies reserve. It is proposed to pay the fixed 6 per cent dividend on the preferred ordinary and an additional 2 per cent (same), and a fixed 6 per cent and an additional dividend of 3 per cent (same) on the ordinary. The balance carried forward is £222,183 (against £210,241 brought in).

The Morgan Crucible Co., Ltd., has declared an interim dividend of 3¾ per cent (unchanged).

Electrical Components, Ltd., has declared an interim ordinary dividend of 7½ per cent, actual (same).

British Relay Wireless & Television, Ltd., has declared an interim dividend on the "A" ordinary of 5 per cent. The directors state that they anticipate recommending a total of 16 per cent for the year.

New Companies

Bonnylight Display Signs Ltd.—Registered 14th January. Capital £1,500. Manufacturers of and dealers in neon and electric signs, etc. Directors: F. W. Jenks and W. E. Ingram. Regd. office: 6/8, Holloway Head, Birmingham.

Alaska Manufacturing Co., Ltd.—Registered 25th January. Capital £1,000. Manufacturers of and dealers in electrical, refrigeration and engineering articles and equipment, etc. Directors: H. W. Gore, H. Salmond, Wm. W. Riber, G. E. H. Briers, Wm. C. Ericsson and D. Schildbach. Regd. office: Martins Bank Chambers, Nelson, Lancs.

R. H. Dent (Electrical), Ltd.—Registered 23rd January. Capital £8,000. To acquire the business of an electrical wholesaler carried on by Jenny Dent at Manchester, as R. H. Dent, etc. Directors: Miss Jenny Dent, F. D. Dent, and W. G. Dent. Regd. office: 67, Bridge Street, Manchester, 3.

Aquamix, Ltd.—Registered 21st January. Manufacturers of and dealers in refrigerators of all kinds, and all kinds of freezing, cold storage, air-conditioning, heating, cooking and lighting equipment and accessories, etc. Directors: A. W. Lambert and M. Shaw. Regd. office: 25, Birley Street, Blackpool.

Edward Onions, Ltd.—Registered 27th January. Capital £100. To acquire the business now carried on by E. Onions, at 4, Martin Road, Tipton, and to carry on the business of electrical contractors and manufacturers, wireless, television and electronic engineers, etc. Directors: E. Onions, Dorothy E. Onions, and S. W. Nettles. Regd. office: 4, Martin Road, Tipton, Staffs.

Arabian Electrical Co. (Kuwait), Ltd.—Registered 26th January. Capital £100. Electrical engineers, engineers' agents, etc. Directors: M. C. Jones, and R. G. Watts. Regd. office: Clock House, Arundel Street, W.C.2.

Liquidation

Tuckers Radio Service, Ltd.—Winding up voluntarily. Liquidator, Mr. N. W. Osborne, 11–12, Finsbury Square, London, E.C.2.

Bankruptcy

W. S. Forrest, 45, Carholme Road, Lincoln, electrical engineer.—Trustee, Mr. E. C. Stimpson, 27, Regent Street, Park Row, Nottingham, Official Receiver, released 20th January, 1954.

Australian Imports and Exports

IMPORTS of dynamo-electric machinery and electrical appliances and equipment into Australia during the financial year ended with June last totalled £A26,656,000 in value compared with £A34,947,000 during the preceding twelve months. From the accompanying table giving the values of the chief groups it will be seen that the decline ran through nearly all.

Class of Goods	Year ended June 1952 £A000	Year ended June 1953 £A000
Batteries & accumulators	1,012	349
Cable and wire, covered	3,197	3,533
Communication equipment, including radio	5,595	2,982
Dynamo-elec. machines	8,342	6,550
Heating and cooking appliances	2,179	264
Lamps, filament ..	1,194	410
Protective equipment ..	802	729
Regulating, starting and controlling equipment	5,036	5,097
Sparking plugs ..	695	314
Transformers & rectifiers	3,895	4,193
Electrical machinery and appliances, n.e.i. ..	3,000	2,235

During the same period Australian exports of dynamo-electric machinery and electrical appliances and equipment totalled £A1,628,000 in value compared with £A1,765,000 in 1951–52. The total included batteries and accumulators £A335,000 (£A399,000) and communication equipment £A479,000 (£A500,000).

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 20th February:—

BAK-VAC. No. 724,355, Class 9. Electric vacuum cleaners.—New Welbeck, Ltd., 94, New Bedford Road, Luton.

SIGNALUX. No. 720,882, Class 9. Electrical interrupting apparatus included in Class 9 and luminous discs for use in indicating the position of such apparatus.—Sinavia Société Anonyme, Bruxelles-Ixelles, Belgium. Address for service, c/o W. Symmons & Co., Bank Chambers, 329, High Holborn, London, W.C.1.

CHEMRING. No. 723,296, Class 9. Scientific, nautical, surveying and electrical apparatus and instruments, all included in Class 9; radio and radar apparatus and instruments; measuring, signalling, life-saving and teaching apparatus and instruments, etc.—Chemring, Ltd., 62–64, Temple Chambers, Temple Avenue, London, E.C.4.

VECTORAD. No. 724,811, Class 11. Combined electric radiators and convection heaters for space heating.—Dorset Light Industries, Ltd., 70, East Street, Bridport, Dorset.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 17th March from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1948

23058. Dubilier Condenser Co. (1925), Ltd. (Dubilier, W.).—Electric condensers. 28th September, 1949. (705472.)

28349. Williams, F. C., and Kilburn, T.—Electrical information storage. 22nd October, 1949. Addition to 657591. (705474.)

33190. Robinson, A. A.—Circuit for multiplying binary numbers. 10th December, 1949. (705476.)

33192. Williams, F. C., Robinson, A. A., and Kilburn, T.—Electric pulse-selecting circuits. 10th December, 1949. (705477.)

1949

1312. Tootill, G. C.—Electronic computing circuits. 22nd December, 1949. (705478.)

2680. National Research Development Corporation.—Electronic digital computing devices. 16th January, 1950. (705479.) 15187.—Electronic digital computers. 19th May, 1950. (705482.) 15188.—Electrical information storage means. 19th May, 1950. (705483.) 20625.—Electrical signal detecting and amplifying systems. 13th July, 1950. (705487.) 29138.—Electronic storage devices. 27th October, 1950. (705492.) 29139.—Electronic information storage devices. 30th October, 1950. (705493.) 29945.—Electronic information storing devices. 1st November, 1950. (705495.) 30908.—Electrical storage apparatus. 21st November, 1950. (705496.)

29834. Wilson & Longbottom, Ltd., and Porter, I. S.—Electrical warp stop motions for looms. 3rd July, 1950. (705494.)

33296. Ferranti, Ltd., and Pollard, B. W.—Binary electric pulse coding systems. 29th March, 1951. (705497.)

1950

1501 & 4050. National Research Development Corporation.—Electronic information storage devices. 10th January and 1st February, 1951. (705498/9.)

5106. Marconi's Wireless Telegraph Co., Ltd.—Television-kinematograph apparatus. 18th October, 1950. (705500.)

12795. General Electric Co., Ltd., and Wannell, A. W.—Bearing bushes or liners. 22nd May, 1951. (705659.)

14721. National Research Development Corporation.—Electric cable connectors. 13th June, 1951. (705831.)

14860. British Tabulating Machine Co., Ltd.—Electronic multiplying apparatus. 14th June, 1950. (705574.)

16776. Ray-o-Vac Co.—Alkaline electric dry cells. 5th July, 1950. (705501.)

18204. National Research Development Corporation.—Electrostatic storage of information. 11th July, 1951. (705502.) 23489.—Electronic storage of information. 21st August, 1951. (705504.)

24979. Edison Swan Electric Co., Ltd.—Method and means for the production of rods of polytetrafluorethylene and like materials. 10th January, 1952. (705586.)

25401. Dowty Equipment, Ltd.—Electromagnets. 5th October, 1951. (705834.)

26459. Siemens-Schuckertwerke Akt.-Ges.—Forced flow tubular boilers. 30th October, 1950. (705836.)

27969. Belling & Lee, Ltd.—Device for end trimming electric cables. 6th November, 1951. (705668.)

30458. Shardlow Electric Wires, Ltd., and Moulton, E. W.—Aerials for the reception of television and like high frequency wireless signals. 13th December, 1951. (705591.)

31150. Clarke, Chapman & Co., Ltd.—Control gear for electric winches, capstans and the like. 20th March, 1952. (705594.)

31343. Ferranti, Ltd.—Valve systems for the control of fluid pressure. 3rd January, 1952. (705669.)

1951

557. Standard Telephones & Cables, Ltd.—Telecommunication exchanges. 8th January, 1951. (705839.)

649. National Research Development Corporation.—Electrostatic storage of information. 9th January, 1952. Addition to 657591 and 705474. (705508.)

1332. Sylvania Electric Products, Inc.—Electron discharge devices. 17th January, 1951. (705740.)

2539. British Tabulating Machine Co., Ltd.—Electronic translating means. 15th January, 1952. (705840.)

3262. National Research Development Corporation.—Electrostatic storage of digital information. 31st January, 1952. (705510.)

3391. Gilfillan Bros., Inc.—Magnetic means for producing compensations in a cathode-ray tube. 12th February, 1951. (705676.)

4116. British Thomson-Houston Co., Ltd.—Magnetic amplifiers. 20th February, 1951. (705677.)

4638. Metropolitan-Vickers Electrical Co., Ltd.—Saturable core reactance devices. 8th January, 1952. (705678.)

4679. National Research Development Corporation.—Electrostatic storage of digital information. 23rd May, 1952. (705513.)

5137. General Electric Co., Ltd., and Sowter, A. B.—Methods of making electrical connection to aluminium or aluminium alloy members. 11th February, 1952. (705843.)

6411. General Electric Co., Ltd., and Sowter, A. B.—Pressure welding. 19th February, 1952. (705748.)

6419. Siemens-Schuckertwerke Akt.-Ges.—Mercury vapour discharge vessels. 16th March, 1951. (705679.)

6936. Jansen, B.—Spring action driving gear with variable torque for on-load change-over switches of regulating transformers. 22nd March, 1951. (705845.)

7284. English Electric Co., Ltd.—Connection of aluminium to metals of higher melting point. 31st March, 1952. (705749.)

7670. National Research Development Corporation.—Electronic amplifier systems. 25th March, 1952. (705603.)

8623. Heinrich, D. O.—Voltage control means, especially for electro-precipitators. 18th March, 1952. (705604.)

9212. Marconi's Wireless Telegraph Co., Ltd.—Mixer circuit arrangements for use at ultra-high frequencies. 5th March, 1952. (705685.)

10939. General Electric Co., Ltd., Cates, J., and Jenkins, H. G.—Electric circuit arrangements for operating electric-discharge lamps. 18th April, 1952. (705687.)

11051. Metropolitan-Vickers Electrical Co., Ltd.—Dynamo-electric machines. 28th March, 1952. (705848.)

11180. Murphy Radio, Ltd.—Scanning circuits for television apparatus. 12th May, 1952. (705752.)

11195. General Electric Co., Ltd., and Runciman, R. D.—Vibrator units for producing an alternating current from a direct current. 12th May, 1952. (705849.)

13160. Capps, M. W. R., Capps, N. C., and Capps, A. W. F.—Domestic and the like heating systems employing the heat-pump principle. 29th May, 1952. Cognate application 15926, 5th July, 1951. (705691.)

16209. Voltohm Processes, Ltd.—Manufacturing process of an electric metal resistance. 9th July, 1951. (705606.)

16671. Syncro Machine Co.—Electric motor control system for spooling apparatus. 13th July, 1951. (705699.)

19976. Fischer, R. H.—Turbine power plant. 27th November, 1951. (705611.)

20499. Jung Ges., A.—Electrical contacts. 30th August, 1951. (705758.)

20617. Siemens & Halske Akt.-Ges.—Image-forming systems consisting of four magnetic electron lenses, for electron microscopes. 31st August, 1951. (705867.)

20942. Babcock & Wilcox, Ltd.—Vapour generating and superheating units. 5th September, 1951. (705713.)

21571. Planer, V., and Planer, G. V.—Insulated electric cables. 13th September, 1951. (705614.)

22154. Dubilier Condenser Co. (1925), Ltd. (Dubilier, W.).—Electric condensers. 28th September, 1949. Divided out of 705472. (705521.)

22463. Dorman & Smith, Ltd.—Connecting devices for electrical conductors. 22nd December, 1952. (705522.)

22611. British Telecommunications Research, Ltd.—Electric signalling systems. 11th September, 1952. (705717.)

23222. Naamlooze Vennootschap Philips' Gloeilampenfabrieken.—Refrigerating apparatus. 5th October, 1951. (705718.)

23853. Siemens Bros. & Co., Ltd.—Microphones. 17th July, 1952. (705523.)

25559. Forges et Ateliers de Constructions Electriques de Jeumont.—Delayed-release relays. 1st November, 1951. (705763.)

27331. Telefonaktiebolaget L. M. Ericsson.—Signal impulse receiving devices for telephone lines. 21st November, 1951. (705723.)

27935. Radio Corporation of America.—Sealed microwave absorptive gas cell and method and means for fabricating same. 28th November, 1951. (705876.)

29475. Philips Electrical Industries, Ltd.—Circuits for synchronizing relaxation oscillators. 17th December, 1951. (705731.)

30139. Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz.—Regulating devices for electric generators. 24th December, 1951. (705733.)

1952

2864. Combustion Control Corporation.—Photo-conductive cell. 4th February, 1952. (705739.)

3266. British Thomson-Houston Co., Ltd.—Cathode-ray tubes. 6th January, 1953. (705880.)

3592. Centre National de la Recherche Scientifique.—Telephone receivers. 11th February, 1952. (705775.)

5484. International Resistance Co.—Method and apparatus for making rectifier cells. 3rd March, 1952. (705626.)

6162. Philips Electrical Industries, Ltd.—Multi-pole electric networks. 10th March, 1952. (705628.)

6249. General Electric Co., Ltd., and Rose, W. R.—Electromagnetic step-by-step switches. 28th January, 1953. (705882.)

6728. Compagnie Générale de Télégraphie sans Fil.—High gain travelling wave tube of the magnetron type. 14th March, 1952. (705783.)

7101. Philips Electrical Industries, Ltd.—Method of manufacturing cathodes for use in electric discharge tubes and cathodes manufactured by this method. 19th March, 1952. (705537.)

7521. British Thomson-Houston Co., Ltd.—Gas-filled grid-controlled electronic devices. 24th March, 1952. (705785.)

9100. Siemens Schuckertwerke Akt.-Ges.—Cable installations having multi-core electric cables. 9th April, 1952. (705540.)

9253. British Thomson-Houston Co., Ltd.—Temperature responsive control circuits. 10th April, 1952. (705884.)

9395. Philips Electrical Industries, Ltd.—High-frequency furnaces. 15th April, 1952. (705788.)

9585. Compagnie Générale de Télégraphie sans Fil.—Delay lines suitable for use in travelling wave discharge tube arrangements. 16th April, 1952. (705885.)

10234. Standard Telephones & Cables, Ltd.—Relaxation oscillators. 23rd April, 1952. (705635.)

10715. Electrical Apparatus Co., Ltd.—Electric contact breaking apparatus having arc extinguishing arrangements. 29th April, 1952. (705797.)

10779. Electro-Mécanique de l'Aveyron.—Eddy-current electric brakes. 29th April, 1952. (705636.)

11103. Badische Anilin- & Soda-Fabrik.—Electrolytic cells. 2nd May, 1952. Addition to 667477. (705541.)

12799. Bentham, H. M.—Mounting of electric switches in wall boxes. 27th January, 1953. (705800.)

13554. British Thomson-Houston Co., Ltd.—Electric-discharge devices. 28th May, 1952. (705801.)

16540. Illinois Institute of Technology, Armour Research Foundation of the.—Magnetic transducer head. 9th January, 1951. Divided out of 705507. (705546.)

16930. United-Carr Fastener Corporation.—Electric lamp sockets. 4th July, 1952. (705809.)

17146. Westinghouse Brake & Signal Co., Ltd., and Walker, A. H. B.—Stand-by systems for d.c. power supplies. 29th May, 1953. (705547.)

19514. Standard Telephones & Cables, Ltd. (Federal Telecommunication Laboratories, Inc.).—Translator for electric pulse code communication systems. 1st August, 1952. (705813.)

20809. Ray-o-Vac Co.—Alkaline electric cells. 6th July, 1950. Divided out of 705507. (705554.)

20886. Felten & Guilleaume Carlswerk Akt.-Ges.—Arrangement for the automatic switching on of spare tubes in unattended amplifier stations. 20th August, 1952. (705817.)

21440. Hanovia, Ltd., and Druce, W. J.—Electrical insulating means. 30th April, 1953. (705819.)

24986. General Electric Co.—Dynamo electric machines. 6th October, 1952. (705650.)

25059. Dynamatic Corporation.—Eddy current couplings, brakes and dynamometers. 7th October, 1952. (705559.)

26952. Chatham Electronics Corporation.—Electrode structures for gaseous discharge devices. 27th October, 1952. (705827.)

29639. British Thomson-Houston Co., Ltd.—Electric lamp mount positioning devices. 24th November, 1952. (705899.)

Canadian Electrical Manufacture

ACCORDING to final figures just issued in Ottawa the total "selling value at works" of the products made in the Canadian electrical apparatus and supplies industry in 1952 amounted to about $716 million compared with $676 million in 1951. These totals cover the bulk, though not all, of such products made in the Dominion; some —e.g. washing machines—were made by concerns primarily engaged in other business and are therefore not included. Official estimates are that for 1952 a sum of about $119 million on that and similar account should be added to the total of $716 million mentioned above. This means that Canada turned out approximately 45 per cent more electrical apparatus and supplies than she did in 1948.

Comparative values for the two years 1952 and 1951 are given in the accompanying table. With a few exceptions variations were not great. Among increases switchgear, transformers and welding apparatus were noteworthy, while among decreases convertor equipment, motors and heating and cooking and refrigerating apparatus may be mentioned. In the motor group the production of those for railway and vehicle use was only about half that of 1951.

Interesting developments are shown in connection with the manufacture of radio and television equipment. It is not surprising to find that the production of the latter has overtaken that of radio receivers. The value of receiving sets made was less than in any year since 1946. That of radio receiving valves declined while that of television valves stood at $2,325,000 and numbered 120,141. Television sets produced in 1952 numbered 141,946 valued at $30 million compared with 48,657 valued at about $13 million in 1951 and no more than four worth $931 in 1948.

Another point that stands out is that the production of fluorescent lamps was less than in any year since 1949 while that of standard incandescent lamps was well maintained.

Class of Goods	Selling value at works 1951 $ (000)	1952 $ (000)
Convertor equipment ..	4,132	2,325
Indus. control apparatus	11,034	13,546
Generators and parts ..	16,780	17,718
Motors and parts ..	41,825	33,976
Switchgear and protective equipment	35,626	41,521
Transformers and parts	48,161	57,738
Welding apparatus ..	3,748	5,796
Stoves, rangettes and cooking plates ..	12,802	11,858
Heating elements for stoves, etc.	2,733	2,253
Air heaters, electric, portable	581	533
Heating pads, electric ..	477	436
Water heaters, electric	1,481	1,134
Flat irons, electric ..	2,646	2,574
Toasters, electric ..	1,540	1,252
Unspecified cooking and heating apparatus ..	2,714	2,771
Vacuum cleaners and parts	8,902	8,585
Fans, portable	946	517
„ other	604	478
Unspecified motor-driven appliances, including washing machines, air conditioners, etc. ..	11,369	12,553
Food mixers, electric ..	1,744	1,683
Refrigeration equipment	63,907	51,206
Batteries, storage ..	20,200	21,233
„ dry cell ..	8,903	8,627
Parts and supplies for batteries, and wet cell type batteries ..	2,460	2,144
Conduit and fittings ..	7,494	7,579
Cut-outs and fuses ..	4,393	3,689
Electro - therapeutic apparatus	727	763
Elec. industrial furnaces	356	645
Elec. industrial ovens and other heating equipment	1,812	1,521
Watt-hour meters ..	7,211	6,190
Elec. indicating instruments	540	800
Other elec. instruments and meters	1,183	1,355
Parts for instruments and meters	1,322	1,012
Lamps, incandescent ..	12,177	13,999
„ fluorescent ..	3,252	2,817
Lighting fixtures ..	21,565	20,625
Line material ..	6,173	7,181
Radio receiving sets, civilian	29,635	22,179
Record players, elec. ..	1,413	1,718
Radio transmission equipment, civilian ..	3,530	5,293
Radio equipment, military	*	16,401
Radar equipment ..	*	26,504
Radio condensers ..	2,525	2,507
Television sets ..	12,902	30,073
„ equipment, other	365	634
Other radio and electronic equipment, except tubes and transformers	21,562	9,256
Traffic signal systems ..	321	410
Fire alarm signals ..	500	565
Interior signal and clock systems excluding telephone	999	867
Vacuum tubes	6,283	7,131
Wiring devices ..	15,629	12,698
Wires and cables ..	115,204	111,819
Telephone materials, including switchboards, telephones, transmitters, etc.	40,255	40,229
Rectifiers for charging storage batteries ..	767	1,098

* Not available.

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Bath.—24th February. City Council. Electrical installations in 20 houses, Moorlands estate. Planning officer and architect, 7, North Parade Buildings.

Blyth (Northumberland).—Corporation. Electrical equipment for the electrification of 349 houses. Borough engineer.

Brazil.—28th February. Mechanical and electrical plant for a hydro-electric station at Cachoeira Dourada, including two 18,500 h.p. turbines and two 14,800/18,000 kVA alternators. (E.S.B. 215/54. Ten/8061.)*

PORTO ALEGRE.—22nd February. Comissao Estadual de Energia Eletrica. 26,000 electricity meters. (E.S.B. 2231/54. Ten/8159).*

Brentwood.—13th February. U.D.C. Lamps for one year. Surveyor, Council Offices.

Canada. — WINNIPEG. — 15th March. Manitoba Hydro-Electric Board. Two 30,000 kW steam turbo-generator sets for a power station to be built near Brandon. (C.R.E. 1031/54. Ten/8139.)*

Clydebank.—16th February. Corporation. Street lighting equipment. (See this issue.)

Donegal.—26th February. County Council. Electrical installation in the proposed new county hospital at Letterkenny. J. A. Kenny & Partners, consulting engineers, 44, Kildare Street, Dublin, C.17.

Durham.—County Education Committee. Electrical installation in the Hartlepool Hart Road County School and Hartlepool Baltic Street County School. County architect, Court Lane, Durham.

Edinburgh.—North of Scotland Hydro-Electric Board. 132 kV transmission line from Fort Augustus to Fort William. (See this issue.)

Gloucester.—Corporation. Electrical installation at Matson Junior–Infants' school. (See this issue.)

Heckmondwike.— 12th February. U.D.C. Electrical work for 36 houses, Dale Lane estate. Surveyor, Council Offices, 6, Church Walk.

Ilford.—24th March. Corporation. Sewage pumping plant. (See this issue.)

India.—NEW DELHI.—18th February. Director General of Supplies & Disposals. Cables and cable boxes. (E.S.B. 1932/54. Ten/8137.)*

4th March. Director-General (Stores Division), G.P.O. Receiving, rectifying and transmitting valves. (E.S.B. 2096/54. Ten/8161).*

BANGALORE.—15th February. Stores Purchase Committee, Government of Mysore. Copper conductor for overhead power transmission lines. (E.S.B. 2678/54. Ten/8204.)*

Irish Republic.—CLONMEL.—26th February. District mental hospital. Electrically driven hydro extractor. (E.S.B. 2510/54. Ten/8181.)*

Leicester.—18th February. County Education Committee. Clocks for schools. Director of education, Grey Friars Offices.

Louth.—15th February. County Vocational Education Committee. Fluorescent lighting fittings and incidental wiring in the boys' and girls' technical schlools Dundalk. J. V. Tierney & Co., consuting, engineers, 15/16, Duke Street, Dublin.

New Zealand. — AUCKLAND. — 26th March. Waitemeta Electric Power Board. 11 kV and 33 kV switchgear. (E.S.B. 1863/54. Ten/8152.)* 11th June. Three 10 MVA and five 7·5 MVA double-wound transformers. (E.S.B. 1862/54. Ten/8154.)*

WELLINGTON. — State Hydro-Electric Department. Four single-phase, double wound, transformer units, each of 3,333 kVA, 110/6·35 kV, 50 c/s, outdoor type, oil immersed, self-cooled with on-load tap changing. (E.S.B. 1836/54. Ten/8153.)*

3rd March. Director-General (Stores Division), General Post Office. Sheathed cable. (E.S.B. 2412/54. Ten/8172.)*

10th March. Industrial fans and electric heaters. (E.S.B. 2097/54. Ten/8166.)* 11th March. Telephone cable. (E.S.B. 2000/54. Ten/8171.)*

24th March. Varnished cotton sleeving. (E.S.B. 2100/54. Ten/8188.)*

8th April. Medium-frequency coast station transmitter for use in the tropics. (E.S.B. 2281/54. Ten/8175.)*

Norwich.— 15th February. City Council. Lamps for one year. City engineer, City Hall.

Preston.—4th March. Education Committee. Electrical installation for Ashton new county secondary school. Borough engineer, Municipal Building.

South Africa. — DURBAN. — 5th March. City Council. One 7-panel switchboard, 33 kV, 1,000 MVA breaking capacity. (E.S.B. 1903/54. Ten/8144.)*

12th March. Two 750 MVA 33 kV circuit breakers and six 33 kV air break switches of not less than 300 A capacity. (E.S.B. 2571/54. Ten/8187.)*

PRETORIA.—18th February. Union Tender & Supplies Board. Electric cable. (E.S.B. 2232/54. Ten/8157).* Telephone switchboard equipment. (E.S.B. 2392/54. Ten/8169.)* Electronic valves, torches and cycle lamps. (E.S.B. 2534/54. Ten/8191.)*

Sunderland.—Town Council. Electrical installation at Havelock Primary Infants' School hutment extension. J. E. Lewis, borough engineer, 27, Fawcett Street.

United States.—PORTLAND.—12th February. Bonneville Power Administration. Power circuit breakers. (E.S.B. 2331/54. Ten/8182.)*

Whitley Bay.—U.D.C. Installation of electricity in about 200 council houses. E. Roberts, surveyor, Council Offices.

ORDERS PLACED

Durham.—County Education Committee. Electrical work in schools: Benfieldside County and Modern (£266).—Gray Brothers. Durham New Technical College (£11,483).—North of England Engineering & Electrical Co. Fishburn New County Infants' (£1,036).—A. Higginbottom & Son. Kelloe County (£222).—Gray Brothers.

Frome.—U.D.C. Electrical installations in 64 "Cornish Unit" houses (£2,340).—Frome Central Electrical Contractors.

Hartley Wintney.—R.D.C. Electrical wiring of 172 pre-war Council houses (£2,604).—W. P. Bond.

Newcastle-on-Tyne. — City Council. Installation of electricity in 97 houses on the Fergusons Lane estate, 103 houses on the Benwell Dene estate, 208 flats on the Delaval Road estate, and 84 flats and 14 common staircases at the Leazes Dwellings.—J. & D. Ellison. Similar work in 473 houses and flats on the Cowgate estate.—Bernard Berrie (Newcastle).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Abbots Langley.—Houses (90), Cecil Lodge estate; Bury Building Co., Ltd., Bury Street, Ruislip.

Abergavenny.—Shop premises, High Street; Wyman & Sons, Ltd., 53/55, New Bond Street, W.1.

Aldridge.—Group of 12 factory units on the Red House Industrial Estate; C. Andreason, U.D.C. surveyor, Daw End, Rushall, Walsall.

Aylesbury.—Works extensions; Air Trainers, Ltd., Aston Works, Southern Road.

Bangor.—Out-patients' department at County Hospital; Richard & Douglas Hall, architects, High Street.

Bexley.—Houses (74), at Wickham Street, Chaucer Road, Welling; borough surveyor, West Lodge, Broadway, Bexleyheath.

Birkenhead. — Factory, Corporation Road, for N. W. Industrial Estates, Ltd., Derby House, Exchange Buildings, Chapel Street, Liverpool.

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

Blackpool.—Houses (92), Matthews & Turner, Ltd., Rivington Avenue.

Blyth.—Houses (128); borough surveyor, Municipal Buildings.

Bollington.—Factory, Kerridge; Eric Britton & Co., Ltd., bias binding manufacturers, Ingersley Vale Works, Bollington, Macclesfield.

Bradford.—Fire station at Idle; Thos. Obank & Sons, Ltd., Thackley, Idle, Bradford.

Brighton.—Erection of six classrooms at Woodingdean Primary school, Brighton; borough engineer and surveyor, 26-30, King's Road, Brighton, 1.

Burnley.—Bus depot; Ribble Motor Services, Ltd., Frenchwood Avenue, Preston.

Chigwell.—Flats (32), Rectory Lane, Loughton; Tooley & Foster, architects, Midland Bank Chambers, Buckhurst Hill.

Cleator Moor (Cumberland). — Factory additions for the Cumberland Paper Co.; John Laing & Sons, builders, Dalston Road, Carlisle.

Colwyn Bay.—Three blocks of flats; T. A. Hughes, Ltd., Hillside Yard, Llanerch Road, Rhos-on-Sea, N. Wales.

Coventry.—Civic theatre in Corporation Street with ground floor shops, etc. (£180,000); D. E. E. Gibson, city architect, Bull Yard, off Warwick Row.

Cumberland.—Branch library at Maryport, additions to Nelson School, Wigton, Penruddock School, Penrith, and Gilsland Controlled School, and further instalment of plan for new school at Workington; county architect, Portland Square, Carlisle.

Dorking. — Houses (62), Bennetts Wood, for R.D.C.; clerk, Brookmead, Dorking.

Droylesden.—Dwellings (54), Gloucester Road site; Frank Bradley, architect, Penny Bank Chambers, Wood Street, Bolton.

Durham.—Proposed infants' schools at South Stanley, Wardley and Trimdon Village; county architect, Court Lane, Durham.

East Barnet.—Dwellings (108), Bohun Lodge estate, Cat Hill; U.D.C. surveyor.

Edmonton.—Houses (300), Potters Bar estate; borough architect.

Gateshead.—Proposed primary school at Leam Lane for the E.C.; R. W. Gregory & Partners, electrical consultants, Pilgrim House, Newcastle-on-Tyne.

Great Yarmouth.—Licensed premises, South Quay; Buckingham & Berry, architects, 10, Thorpe Road, Norwich.

Dwellings (32), Hertford Way; borough surveyor.

Halifax.—Works extensions (£45,000); L. Harris, Ltd., West Parade.

Haslingden.—Houses (21) and flats (8), Longshoot estate; L. Frankland (Contractors), Ltd., Antley Buildings, Blackburn Road, Accrington.

Hastings.—Houses (143), Fairlight; borough surveyor, 37, Wellington Square.

Hebburn - on - Tyne.—Houses (190), Monkton Lane; U.D.C. surveyor.

Hemsworth. — Houses (38) for U.D.C.; J. Miller & Partners, Ltd., Four Mile Works, Newmillerdam, Wakefield.

Hinckley (Leics).—Flats (100) during next two years; Council's surveyor.

Jarrow - on - Tyne. — Canteen, Bede trading estate (£17,000), for North Eastern Trading Estates, Ltd., Team Valley, Gateshead.

Leeds. — Physiotherapy department building at Marguerite Hepton Memorial Hospital, Thorp Arch; architect to the Regional Hospital Board, Park Parade, Harrogate.

Liverpool.—Dock sheds at Huskisson Dock (£2,000,000); Mersey Docks and Harbour Board, Dock Office, George's Pierhead, 3.

London.—CAMBERWELL.—Factory, Latona Road, etc.; W. J. Harris & Co., Ltd., baby carriage manufacturers, 65, Haymerle Road, S.E.15.

HOLBORN.—Factory, offices, etc., at Hatton Garden; Raphaels, Ltd., manufacturing opticians, Apollo Works, Charlton Kings Road, N.W.5.

KENSINGTON.—R.C. church, High Street; A. G. Scott, architect, 3, Field Court, Gray's Inn, W.C.1.

Longbenton.—Houses (130), Fordley, for U.D.C.; A. E. Sweetman, surveyor, Council Offices, Forest Hall, Newcastle-on-Tyne.

Loughton.—R.C. primary school, Debden estate; R. A. Boxall, architect, 161, London Road, Chelmsford.

Louth (Lincs).—Houses (72) ; borough architect.

Manchester.—Rebuilding part of glue works at Red Bank for C. H. Smith, Ltd.; Arthur Clayton, Duchy Chambers, Clarence Street, Manchester, 2.

Morpeth.—New wing at County Home for the Blind; county architect, County Hall, Newcastle-on-Tyne.

Nelson. — Works extensions, Chapel Street; Fryer & Co. (Nelson), Ltd., confectioners, Victory Factories.

Newcastle-on-Tyne. — Additions to bottling works, Bath Lane, for Newcastle Breweries, Ltd. ; J. Oswald & Sons, architects, 68, Northumberland Street.

North Wales.—Extensions at the North Wales Mental Hospital; S. C. Foulkes, architect, Merton Pwllycrochan Avenue, Colwyn Bay.

Northwich.—Large new premises for I.C.I., Ltd.; R. T. James & Partners, consulting engineers, 6a, Lower Grosvenor Place, London, S.W.1.

Nottingham.—Erection of Whitegate Vale Infants' and Junior Schools; G. A. Pillatt & Son, Ltd., Quorn Road, Nottingham.

Penge.—Flats (176), The Triangle, as part of larger scheme, for U.D.C.; B. Fielding, clerk, Town Hall, Anerley Road, S.E.20.

Pontypool.—College of Further Education; C. L. Jones, county architect, Queen's Hill Offices, Newport, Mon.

Portsmouth. — Additional factory premises; Flexible Abrasives, Ltd., Fratton trading estate.

Flats (38), Leigh Park estate; H. E. Collins, Ltd., builders, Eastern Road, Farlington.

Scarborough.—Bus station, Westwood, for East Yorks Motor Services, Ltd.; A. W. Sinclair & Sons, Ltd., 80, Commercial Street.

Sheffield.—College of Technology; J. Stinton Jones & Partners, electrical and heating consultants, 21, Gloucester Place, London, S.W.1.

Smethwick.—Extensions to Council House; R. Holbrow & Partners, quantity surveyors, 68, Harborne Park Road, Birmingham.

Somerset.—School for subnormal children at Elmwood Site, Bridgwater; county architect, County Hall, Taunton.

South Bank - on - Tees. — Additions (£199,000) to No. 6 cogging mill at Cleveland Works of Dorman Long & Co., Ltd., Middlesbrough.

Southgate.—Works extensions; Silver Fleece Steel Wool Co., Ltd., Park Road.

Southport.—First stage of 1,000-bed mental deficiency colony, Greaves Hall, Banks ; Liverpool Regional Hospital Board, 88, Church Street, Liverpool.

South Shields. — R.C. secondary modern school; Page, Son & Hill, architects, 75, King Street.

Stockport.—Police headquarters; G. Bullimore, architect, Lloyds Bank Chambers, Great Underbank, Stockport.

R.C. secondary school, Nangrave Road; Reynolds & Scott, architects, 9, Albert Square, Manchester, 2.

Stockton - on - Tees. — Houses (68), Portrack estate; Teesside Builders, Ltd. Thornaby Road, Thornaby-on-Tees.

Stoke-on-Trent.—Offices; C. Cornes & Sons, Ltd., Lichfield Street, Hanley.

Sunderland. — Proposed Broadway County Primary School (£87,000); A. V. Clerey & Son, builders, Frederick Street.

Proposed shopping centre, Hylton Red House estate, for Ravenseft Properties, Ltd.; L. H. Fewster & Partners, architects, 22, Conduit Street, London, W.1.

Thornton Cleveleys. — Additional classrooms at Beach Road County School; county architect, Preston.

Tiverton.—Works extensions; Stenners of Tiverton, Ltd., engineers, Lowman Works.

Wakefield. — Central works depot (£35,000); city engineer.

Additional offices and showrooms; Comberhill Motors, Ltd., Ings Road.

Watford.—Offices in Clarendon Road; Holst & Co., Ltd., engineers' contractors, 1, Victoria Street, S.W.1.

Wednesbury.—Houses (194), Millfields estate and Mesty Croft; S. J. Smith & Co. (Bidford), Ltd., Smith Road, Wednesbury.

Weymouth.—Houses (50), Littlemoor Road estate; borough surveyor.

Wokingham.—Houses (36), on Pennfields estate, Ruscombe, for R.D.C.; Eric G. V. Hives, architect, 3, Cork Street, Reading.

ELECTRODEPOSITION CONFERENCE

THE fourth International Conference on Electrodeposition and Metal Finishing will be held in London from 20th to 24th April under the ægis of the International Council for Electrodeposition. The technical sessions will be held at the Holborn Restaurant, and in addition there will be a banquet at one of the City's Livery Halls, and a dinner and dance at a well-known London rendezvous. The technical programme will include the presentation of twenty-four papers, and there will be an exhibition of recent advances and developments in electrodeposition and metal finishing techniques and equipment. Forms of application and the detailed programme will shortly be available from the conference secretary, Fourth International Conference, Institute of Metal Finishing, 32, Great Ormond Street, London, W.C.1.